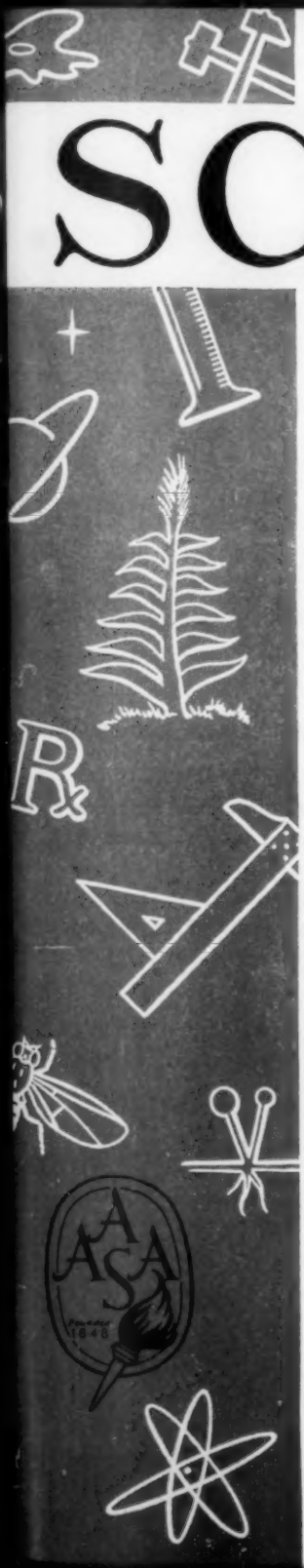

SCIENCE

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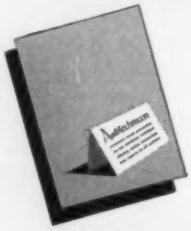

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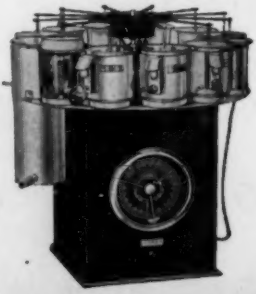

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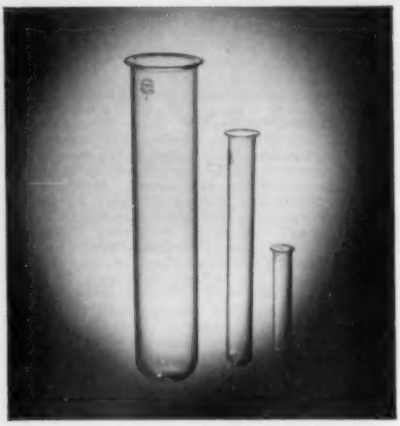

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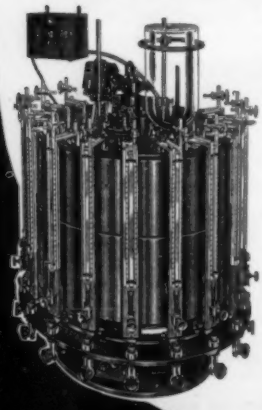

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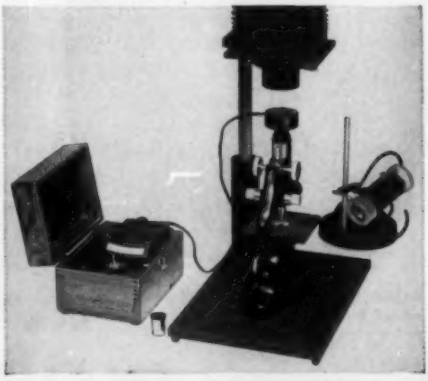

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Arctic Research in North America

DURING the past few years arctic research has assumed a new stature and importance, largely as a result of popular interest which has grown with the realization that the North is a region of economic and military significance. Minerals, fishes, and furs are significant assets, but overshadowing them today is the proximity of Communist Russia, only 2.1 miles away.

New research centers in Alaska and northern Canada are vigorously stimulating arctic research. Geophysics, particularly the physics of the atmosphere, is emphasized at the newly established Geophysical Institute at the University of Alaska, and geophysical work is also being carried out in northern Canada, in part in connection with the Canadian–U. S. military research program at Fort Churchill on Hudson Bay. Meteorological and ionospheric studies are receiving great impetus from observations at new joint Canadian–U. S. weather stations among the Canadian arctic islands and the Danish–U. S. weather station at Thule in northwest Greenland. Physical oceanography is also getting increased attention in the investigations carried out at Point Barrow, Alaska, by the Woods Hole Oceanographic Institution and the Scripps Institution of Oceanography.

In geology extensive work continues in Alaska, northern Canada, and Greenland, primarily by government surveys but also by private organizations. Recent oil exploration by the U. S. Navy in the vicinity of Point Barrow is producing rapid advances in geological knowledge of the Arctic slope, and glaciological work in Alaska by the American Geographical Society and the Arctic Institute of North America is providing basic information. Similarly, the Snow, Ice and Permafrost Research Establishment of the U. S. Army Corps of Engineers illustrates the increasing specialization that characterizes physical investigations pertaining to the North. Photointerpretation of arctic phenomena is part of the research programs sponsored by Cornell and Purdue.

Arctic biology is benefiting greatly from work at the ONR Arctic Research Laboratory at Point Barrow, operated under contract with The Johns Hopkins University. Investigations of the U. S. Public Health Service Research Center at Anchorage, and those of the U. S. Air Force Aeromedical Laboratory at Ladd AFB, Fairbanks, Alaska, are contributing very substantially to progress in medical research, as is work by the Defence Research Board of Canada at Fort Churchill and by Queen's University in northern Canada. The U. S. Fish and Wildlife Service, the Fisheries Research Board of Canada, and the Canadian Wildlife Service have been making significant contributions in subarctic biology for many years and are now extending their investigations farther northward. Agriculture is also pushing poleward with the aid of U. S. and Canadian government financing.

Anthropological research is producing particularly fruitful results in northwestern Alaska, where the New World meets the Old across Bering Strait. Investigations by the University of Alaska are in the forefront among recent contributions to arctic archaeology, although field parties from the Bureau of American Ethnology of the Smithsonian Institution and investigations sponsored by the National Museum of Canada are also yielding noteworthy results.

Favorable influences promoting the general advancement of northern research, especially in Alaska, are the recent Alaskan Science Conferences and the newly founded Alaska Division of the AAAS. Arctic research in general is likewise benefiting by the work of the Arctic Institute of North America, a cooperative U. S.–Canadian organization which, by encouraging and supporting field investigations, is aiding in the development of experienced arctic research personnel, as well as in the acquisition of scientific knowledge. More than fifty universities and private research groups in the United States and Canada are actively engaged in some phase of northern research. In spite of all this activity, many parts of arctic North America remain scientifically unknown.

A. L. WASHBURN
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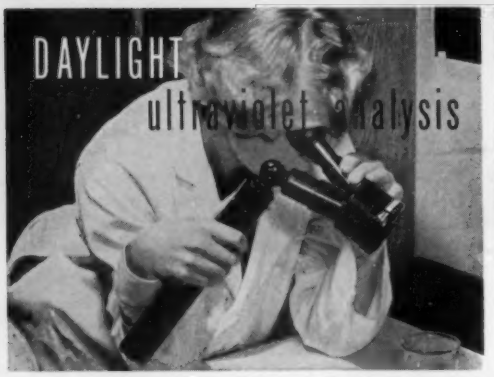

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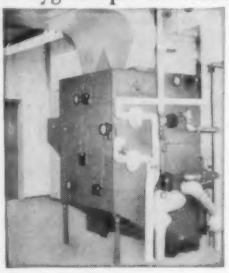

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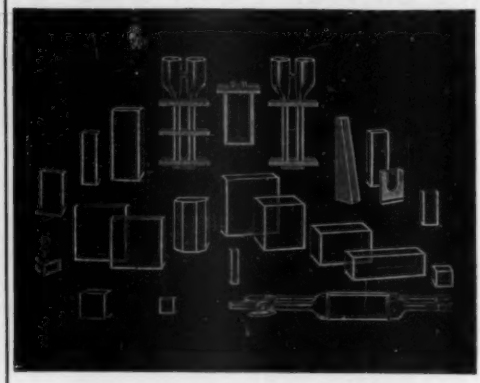

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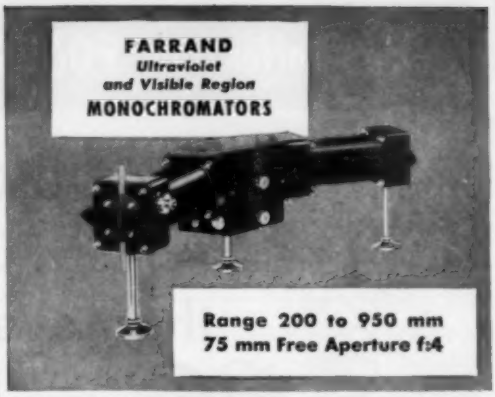

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Cycles in Economics and Nature

George T. Altman
Los Angeles, California

THE EXTREME COMPLEXITY OF ECONOMIC FACTS appears to have concealed or obscured the possibility that the economic relations of human beings may not be wholly *sui generis*. Civilization has resulted in the sublimation of man's wants and in an elaboration and proliferation of his equipment, but it has not yet freed him from his fundamental needs as a living being. Basic principles developed in biometrics may be just as significant in econometrics. It is the purpose here to examine those two sciences, to see whether the cycles that have ruptured economies and generated bloody conflicts may represent merely the natural course of growth revealed in the relations among species.

For this purpose let us take two species, y and v, in loose mutualistic association with each other. Species v has, within the range of our study, an inexhaustible source of food. It prefers to live with y because of y's superior protective equipment. Species y, on the other hand, is greatly aided by v's mobility in reaching the sources of food. The rate of population increase for y is E, assuming maximum cooperation from v; v's rate of increase, however, is k, and $k < E$. Because of y's greater rate of increase and v's ample supply of food, the limiting effect of environment on v is equal to zero. In any case, for the purpose of simplicity at this point we shall assume that it is zero.

From the logistic, placing the limiting coefficient equal to zero, it follows that:

$$v = v_0 e^{kt} \tag{1}$$

and, except for the effect of a shortage of v,

$$y = y_0 e^{Et}. \tag{2}$$

Beginning at a point of equilibrium, $v_0 = y_0$, it follows, since $k < E$, that beyond that point $v < y$.

Here we must note an additional but not uncommon factor, that of time lag. Partly because of y's period of gestation, its rate of increase is not immediately affected by a shortage in reproduction of v. The lapse of time involved in those factors is c, a period which, for all practical purposes, is constant. After c time, however, the y individuals begin to attack each other in the competition for v's cooperation, and their fertility also falls off. As a result, the rate of increase of y falls to E_1, and $E_1 < k$. As a result of the same lag elements, the rate E_1 continues until a period c has elapsed after the y curve has crossed the v curve. Then the adequacy of the supply of v becomes effective, and the rate E goes into effect again.

The form of the curves is shown in Fig. 1. Let t_1 denote the value of t at the first intersection of the y and v curves, t_2, its value at the second such intersection, and so forth, as shown in the figure. It can be seen that

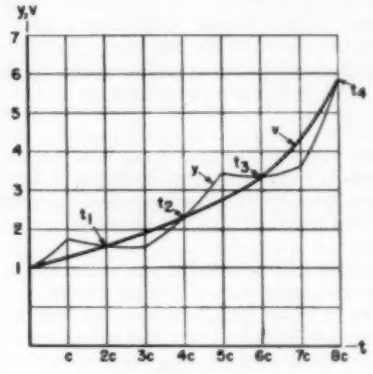

FIG. 1.

From $t = 0$ to $t = c$, $y = y_0 e^{Et}$;
From $t = c$ to $t = t_1 + c$, $y = y_{(t=c)} e^{E_1(t-c)}$;
From $t = t_1 + c$ to $t = t_2 + c$, $y = y_{(t=t_1+c)} e^{E[t-(t_1+c)]}$;

and so on, *ad infinitum*. The period of the y curve from each maximum to the following intersection with the v curve may be derived as follows:

$$\begin{aligned} y_0 e^{kt_1} &= y_0 e^{Ec} e^{E_1(t_1-c)}, \\ kt_1 &= Ec + E_1 t_1 - E_1 c, \\ &= E_1 t_1 + c(E - E_1); \\ kt_1 - E_1 t_1 &= c(E - E_1) \\ t_1 &= c\frac{E - E_1}{k - E_1}, \\ t_1 - c &= \frac{cE - cE_1 - ck + cE_1}{k - E_1}, \\ &= c\frac{E - k}{k - E_1}. \end{aligned}$$

Let us denote the value $\frac{E-k}{k-E_1}$ by d. The period of the y curve from the first maximum to the following intersection with the v curve is therefore cd. Therefore, also, $t_1 = cd + c$. In the same manner it can be shown that the period of the y curve from the first minimum to the following intersection with the v curve is c/d, and that $t_2 = 2c + cd + c/d$.

Since precisely the same relations repeat themselves from each subsequent intersection following a minimum, the time interval between maximum and crossover is always cd, and between minimum and crossover it is always c/d. There is a clear periodicity, the period of each cycle being $2c + cd + c/d$. In the special case in which $E - k = k - E_1$, so that $d = 1$, the period

is 4c. The deviations of the y curve from the v curve in terms of their ratio then form a symmetrical series. In order to state such a deviation curve more simply, let $z = (k-E)c + (E-k)t$, where t is measured from the beginning of the particular segment. Then each complete cycle of the deviation curve from a point where y is a maximum has a downward segment according to the equation

$$\frac{y}{v} = e^{-z}, \tag{3}$$

and an upward segment according to the equation

$$\frac{y}{v} = e^{z}. \tag{4}$$

The time interval from maximum to crossover, from crossover to minimum, from minimum to crossover, and from crossover to maximum again, is in each case c, the total period of the cycle being, as above stated, 4c.

The sharp discontinuity of the curve results from the assumed perfection of the lag period, c. If one takes the more realistic view that the impact of the shortage of v is gradual, and that not all members of y are reached by it at the same time, the curve evolves into one lending itself to sinusoidal description,

$$\frac{y}{v} = e^{(E-k)c \sin \frac{\pi}{2c} t} \tag{5}$$

or, in differential form,

$$\frac{dy}{dv} = \frac{k + (E-k)\frac{\pi}{2}\cos\frac{\pi}{2c}t}{k} e^{(E-k)c \sin \frac{\pi}{2c} t}, \tag{6}$$

with t measured in each case from any point $y = v$ and $dy > dv$. It must be clear, however, that Equations (5) and (6) are purely descriptive approximations and are not intended to represent the precise mathematical effect of the forces stated.

Nor, of course, is the situation as simple as Equations (3) and (4) would indicate. Some argument might be made, on the basis of Newton's third law of motion, that $k - E_1$ does tend to equal $E - k$. Considering the complexity of the actual forces, however, it would be idle to belabor that point. For example, the v curve is not wholly unaffected by the y curve. When, as a result of the shortage of v, the mortality of y increases and its fertility falls off, and this continues beyond the point of intersection with the v curve, the v species will in turn suffer because of its dependence in small or great degree on the protection of y. The effect of this is to introduce a secondary cyclicity into the v curve. Even this would not be an adequate description, however. Consideration would also have to be given to any lag factors affecting v, as a result of which the cyclicity of the two curves would be mutual and opposite, and to the extent of the dependence of y on v, and v on y.

A very loose association would produce one result, and a tighter association another. Then, again, one species might be less dependent on the other than the other is on it. In that case there would be an approach to the predator-prey relation, in which a voracious species might multiply rapidly because of an ample food supply, as a result completely consume the supply, and then starve to death for lack of food. These additional factors and variations, however, do not subserve the purpose of this study. Suffice it to say that the population effects of interdependence of species have been tested out and the oscillatory pattern in fact observed.[2]

[1] Derived from the value of $\frac{y}{v}$ at $t = c$ as a maximum.

Symbiosis in the Human Economy

As it was stated at the outset, the things we learn from biometrics may help us along with econometrics. That human beings have reached a stage of almost rigid interdependence is no longer subject to challenge. It would be difficult, moreover, to classify it as pure mutualism. There are many phases and situations in which the economic efforts of some human beings are harmful to others, where the relations, therefore, are of the predator-prey or exploitation type; and there are even cases in which the efforts of individuals or groups are harmful each to the other.

By and large, however, the relations are mutually beneficial. The essence of the situation is specialization and its necessary accompaniment, exchange. Not only is there specialization in classes of work and classes of products. There is specialization as between ownership and work. The extent to which that specialization is beneficial depends upon the extent to which concentration of ownership advances the need of the economy for capital. No clear case has yet been made that it is also beneficial from the standpoint of the quality of management. Whether the concentration of ownership, to the extent that it does not advance the need for capital, is harmful to the economy seems to depend upon other factors.

Among those other factors is the specialization of industry as between capital and consumers' goods, not that the variations in the production of capital goods would be eliminated if such specialization did not exist, but rather that such specialization concentrates the incidence of those variations so as to give greater force to the interdependence of products and thus of the groups of capital and labor employed in their production. It is simply the operation in the economy of the divide-and-conquer principle of war and politics—the law of mass action, as it is known in the physical sciences.

[2] *Principles of Animal Ecology*, by W. C. Allee, A. E. Emerson, Orlando Park, Thomas Park, and K. P. Schmidt (Philadelphia and London: Saunders, 326 [1949]), summarizing the experiments of G. F. Gause, A. J. Lotka, Vito Volterra, Paul Debach, and H. S. Smith. In regard to mutualism generally, see the same work, p. 710, and *Mathematical Biology*, by V. A. Kostitzin (Paris: Armand Colin., 145 [1937]). In regard to the cycle developed by the predator-prey relationship, see the precise exposition of Volterra's laws in Kostitzin, *op. cit.*, p. 131. See also "Mathematical Analysis of Growth of Mixed Populations," by C. P. Winsor, *Cold Spring Harbor Symposia on Quantitative Biology*. Cold Spring Harbor, N. Y.: Biological Laboratory, Vol. II, 181 [1934].

But that factor presents only a problem of intensity. The basic factor involved on the disadvantage side of concentration of ownership is its effect on the rate of investment. Here we return to the y and v, and E and k of the equations derived from the relations of species. In this case y would refer to total invested capital, v to the capacity of the economy to utilize capital, and E and k to the growth exponentials of those two quantities.[3] E is then the rate of net investment, as a fraction of total invested capital; and k is the rate of growth in the capacity of the economy to utilize capital, as a fraction of that capacity. Such capacity depends upon manpower, natural resources, and, as a dimension of both manpower and natural resources, the level of technology.

E is in fact distinct from k and, without regard to the fluctuations of the business cycle, may not be taken for granted. The rate of investment is in part a function of the supply of investment funds, and that supply is made up in large part of earnings. The extent to which earnings form a source of investment funds depends geometrically upon the level of individual incomes; for investment funds are not merely proportionate to income, but come more readily out of the higher brackets. The level of individual incomes, in turn, depends not only on total income; it depends in part also upon the distribution of earnings, and the distribution of earnings depends to a considerable extent upon the distribution of ownership. In summary, the higher the inequality of ownership, and the higher the level of total production, the greater is the supply of investment funds, *as a percentage of total production,* and the higher therefore is the value of E.

There is one additional point. Over a short period the inequality of earnings is a function, not only of the inequality of ownership, but of the level of total production. Although there is no evidence that on a secular basis there is any relation between the inequality of income and the level of total production, there is some evidence of such a relation in the short run, and it is an element of aggravation that must be considered.

At least this factor of the distribution of income, over both the long and the short periods, is a factor directly influencing E without corresponding effect on k. True, if there is a greater supply of investment funds, and investors as a result will take less compensation for its use, more capital can be used, so that indirectly k is also affected. But actual capital is in the main physical, and the efficiency of its use slopes rapidly either way from an optimum total of capital in use. As a result k is a delicate instrument. If there were no time gap between E and k, a continuous balance between them would no doubt obtain. But there is such a time gap—the length of the supply process, which separates investment from its fruition. We have, then, precisely the same situation here as we have in the relation of interdependent species above described. The cyclical character of production is not merely a result. It is a mathematically necessary result.

[3] The y and v thus used are the same precisely as the C and C_θ, respectively, previously used in the same connection in *Invisible Barrier*, by George T. Altman (Los Angeles: DeVorss & Co., Chap. 7 [1949]).

News and Notes

Scientists in the News

Robert J. Anderson has left the Light Metals Division of the National Production Authority, Washington, and has joined the Southwest Research Institute, San Antonio.

E. Dwight Barnett, director of Harper Hospital in Detroit since 1946, has been appointed first director of Columbia University's Institute of Administrative Medicine, which will begin active operation this month.

Otto A. Bessey has accepted appointment as professor of biochemistry and nutrition, and chairman of the department at the University of Texas Medical Branch, Galveston. Professor Bessey is serving in a similar position at the University of Illinois Medical Center, Chicago.

Francis G. Blake, wartime adviser to the President on problems of epidemic disease and former dean of the Yale Medical School, has been named civilian technical director of medical research in the Office of the Army Surgeon General. Dr. Blake will serve as expert consultant to **John R. Wood,** chairman of the Army Medical Research and Development Board, in the evaluation of current and proposed research projects conducted by Army medical installations and 81 cooperating civilian institutions. He will be responsible for ensuring close coordination between the Army's present $10,079,000 medical research effort and similar programs sponsored by the other armed forces and civilian federal agencies. Now on leave of absence from Yale, Dr. Blake retired in 1951 as chairman of the Committee on Medical Sciences of the RDB.

William F. Cassedy, Jr., has been elected president of Aircraft Radio Corporation succeeding **Lewis M. Hull,** who has become chairman of the board and remains as treasurer. Mr. Cassedy was previously vice president and general manager of Kearfott Manufacturing Co., of Newark, N. J. **Richard W. Seabury,** who has been chairman of the board of Aircraft Radio, is now chairman of the finance committee.

The National Research Council has appointed two new members to the Building Research Advisory Board: **Edmund Claxton,** director of research, Armstrong Cork Company; and **Mason C. Prichard,** special assistant, Office Chief of Engineers for Military Con-

struction, Department of the Army, and chairman, Building Research Activities Committee of the American Society of Civil Engineers.

Benjamin M. Duggar, of Lederle Laboratories, Pearl River, N. Y., who discovered aureomycin in 1948, was recently elected president of the Society of Industrial Microbiology.

Oscar Felsenfeld is on a six months' leave of absence from the Hektoen Institute for Medical Research, Chicago, to lead a party of six conducting research in salmonellosis and amebiasis in Jamaica, Mexico, Costa Rica, Colombia, Peru, and the Guianas. Two salmonella typing centers will be established during the survey. The expedition is sponsored by the Tropical Research Foundation.

T. H. Goodspeed, professor of botany and director of the Botanical Garden on the Berkeley campus of the University of California, is continuing his research on the character and distribution of the vegetation of western South America. This sixth South American expedition is being financed by the Rockefeller Foundation and by donations of funds to the university by a number of private individuals. On invitation from the Chilean government, Dr. Goodspeed will assist in the construction of a National Botanical Garden and Botanical Research Institute on a 450-acre tract near Valparaiso, Chile. **Paul C. Hutchison,** botanist of the university's Botanical Garden, and local collectors in South America will assist Dr. Goodspeed. Dr. Hutchison's participation is being financed by the Kendrick Fund for South American Botanical Investigation.

At the Cuban Academy of Sciences, **A. Edward A. Hudson,** of North Carolina State College, was recently decorated by Carlos Prio Socarras, President of the Republic of Cuba, with the National Order of Merit "Carlos J. Finlay" in the grade of Commander. **Henry Turkel,** of Detroit, and Dr. Hudson were also made honorary members of the Cuban Society of Public Health. Dr. Turkel was also made a corresponding member of the Cuban Society of Biology and Tropical Medicine.

An award of $1,000 has been presented to **T. S. Jobson** by the Employees Suggestion Program of United Air Lines for his proposal to change the routing of DC-6 Mainliners leaving Portland, Ore., southbound under instrument conditions. Captain Jobson has been a United pilot for more than 18 years. His award was the largest made by the Employees Suggestion Program in 1951.

Eugene H. Kone, associate director of the Yale University News Bureau, has resigned to become vice president of Martin Wright and Associates, of New Haven, a New England firm specializing in employee, community, and public relations.

George R. La Rue, professor of zoology, University of Michigan, who will shortly be retired, is a visiting investigator in the Zoological Division, Bureau of Animal Industry, Beltsville, Md.

George T. Lodge has been appointed chief clinical psychologist at the Veterans Administration Hospital, Lebanon, Pa. Dr. Lodge has been chief of the Psychology Section at Letterman Army Hospital in San Francisco for the past two years.

S. E. Luria, of the University of Illinois Bacteriology Department, has been invited by the Society of General Microbiology of England to speak at the annual meeting to be held next April in Oxford. His topic will be a report on "The Mechanism of Virus Multiplication." Professor Luria will also give a lecture at Oxford University, reporting on the work at Illinois on the mechanism and intermediate products of virus synthesis.

James H. Means, of MIT, was the only scientist among the four recipients of the prize awards of the Sidney Hillman Foundation, presented for newspaper and magazine reporting and for authorship of an outstanding novel. Dr. Means' articles supporting the British Labor Government's national health program and attacking the AMA's attitude on socialized medicine were judged prizeworthy by the award committee, consisting of Lewis Gannett, N. Y. *Herald Tribune* book editor; William L. Shirer; and Thomas L. Stokes.

W. E. K. Middleton, head, photometry and colorimetry section, Division of Physics, National Research Council of Canada, has been elected for a four-year term as a member of the Board of Directors of the Optical Society of America.

After 17 years of service, **Walter Mulford,** dean emeritus of the School of Forestry, University of California, has resigned as consulting editor for the "American Forestry" series, published by McGraw-Hill. Professor Mulford's duties have been assumed by his colleague **Henry J. Vaux,** associate professor of forestry at the University of California.

The National Farmers Union has announced that **Lord Boyd Orr,** recipient of the Nobel peace prize in 1949, has been named the winner of its annual award for outstanding service to agriculture. Lord Orr, first director-general of the Food and Agriculture Organization of the United Nations, will come to this country to receive the award at the union's golden anniversary convention in Dallas on Mar. 12.

The board of trustees of the New York School of Social Work, Columbia University, has announced the election of **Dwight R. G. Palmer,** board chairman and chief executive officer of the General Cable Corporation, as a school trustee.

Edwin G. Ramsdell, chief of staff and director of surgery at White Plains Hospital, has been given Columbia University's Lion Award in recognition of his "outstanding service to his country, community,

and to his university." He is a diplomate of the American Board of Surgery, a chevalier of the Legion d'Honneur, and holds the Croix de Guerre for his Army medical service in France in World War I.

Oscar S. Reeder, USAF (MC), has been named chief of the Medical Consultants Division for the Office of Air Force Surgeon General. He has directed orthopedic surgery at Valley Forge General Hospital, Pa.

D. G. Sopwith has been appointed director of mechanical engineering research in the Department of Scientific and Industrial Research (London), succeeding the late **G. A. Hankins.** Dr. Sopwith, who was made superintendent of the Engineering Division, National Physical Laboratory, DSIR, in 1948, has been acting director since Dr. Hankins' death in November 1950.

Francis J. Weiss has been appointed scientific consultant to the National Farmers Union. He was formerly special research consultant to the Sugar Research Foundation.

Two new life members have been elected to the Board of Trustees of the National Geographic Society —**William E. Wrather,** director of the U. S. Geological Survey and treasurer of the AAAS, and **H. Randolph Maddox,** president of the Chesapeake and Potomac Telephone Company, of the Bell System. Dr. Wrather fills the vacancy on the society's 24-man board created by the death last April of **Charles G. Dawes,** and Mr. Maddox fills the vacancy occasioned by the death in September of **Jesse R. Hildebrand,** senior assistant editor of the *National Geographic Magazine.*

Education

Adelphi College, Garden City, N. Y., in expanding its Chemistry Department to award the M.S. degree, has organized a seminar to extend throughout the first year of enrollment. Divided into two parts, the first half is devoted to outside speakers who will discuss the various social science issues in the natural sciences. The second half will be devoted to student participation in a central topic. James Beckerly, AEC director of classification, addressed the last meeting of the first seminar Jan. 17, on "Secrecy Problems in the Atomic Energy Project."

The **American College of Physicians** will sponsor the following postgraduate courses this spring at: Stanford University and the University of California (San Francisco), Feb. 25–29, Gastroenterology; Washington University, Mar. 3–7, Current Concepts of Allergy and Associated Disorders; Mar. 10–15, Cornell University and the New York Hospital, New York City, Diseases of the Blood Vessels; Mar. 17–22, Ohio State University, Clinical Medicine from the Hematologic Viewpoint; Apr. 14–18, University of Michigan, Internal Medicine; May 12–17, Massachusetts General Hospital, Boston, Electrocardiography; May 12–16, Hahnemann Medical College and Hospital of Philadelphia, Trends and Newer Developments in Internal Medicine; June 2–7, University of Toronto, Physiological Basis for Internal Medicine. Where facilities are available, the courses will be open to nonmembers with adequate preliminary training, who should file applications in advance in order to be put on the waiting list.

Nassau Hospital, Mineola, N. Y., will develop new methods for the medical use of atomic energy in a pilot operation in collaboration with Brookhaven National Laboratory. Brookhaven will furnish radioactive material to the hospital and exchange information; later, temporary personnel exchanges for training in radioactive medicine techniques will be made.

The **National Geographic Society,** the **Navy,** and the **Air Force** will participate in an expedition to Khartoum, in the Anglo-Egyptian Sudan, to study the total eclipse of the sun occurring Feb. 25. George Van Biesbroeck, astronomer and physicist, of Yerkes Observatory, will direct the society's part of the project, Edward O. Hulburt, director of research of the Naval Research Laboratory, will make spectral studies for the Navy, and optical and radio measurements of the temperature of the sun's corona and chromosphere will be made for NRL under the direction of John P. Hagen. Scientists from the University of Colorado's High Altitude Observatory will also observe the eclipse.

Trustees of the **New York Zoological Society** have made an initial appropriation of $5,000 to start a program of aid to European scientists working in the biological sciences. First supplies of American technical journals, specimens, and laboratory equipment will be sent abroad early this year, on the basis of a report made by Jocelyn Crane, zoologist, of the Department of Tropical Research, who visited 19 laboratories in Europe while attending the International Entomological Congress last fall. In April Fairfield Osborn, president of the society, will go to Europe for further investigation of the actual needs and work being done. Ross F. Nigrellie, aquarium pathologist, is chairman of the group that will handle the European contacts.

Applications for admission to the 1952–53 session of the **Oak Ridge School of Reactor Technology** must be filed by *Mar. 1,* after which the AEC's Committee of Admission will select approximately 70 students from two categories: A, recent graduates from universities, and, B, representatives from industry and government agencies, all of whom must have a B.S. or higher degree. For additional information write to the school at Box P, Oak Ridge, Tenn.

The first Meyer Bodansky Lectures at the **University of Texas** Medical Branch, Galveston, will be given Feb. 13 by Carl F. and Gerty T. Cori, 1947 Nobel prize winners. The lectureship was established by a group of Galveston businessmen in memory of the late professor of pathological chemistry.

Grants and Fellowships

Grants totaling $1,200,000 have been made by the **Carnegie Foundation for the Advancement of Teaching** to various influential and strategically located Southern institutions for the development of high-quality graduate and research programs, in an effort to solve the critical problem of personnel. Among the universities are Duke, Emory, North Carolina, Tulane, and Vanderbilt. Funds for the five-year program will be used to supplement professional salaries and stipends to selected graduate students.

The **University of Illinois** will award 10 graduate fellowships in the medical and allied health sciences, with stipends ranging from $1,200 to $2,400. Applicants need not have completed clinical internships. Application forms, which must be returned before *Feb. 15,* may be obtained from the Associate Dean, Graduate College, 808 S. Wood St., Chicago 12, Ill.

In addition to the summer fellowships at Woods Hole (SCIENCE, **114,** 564 [1951]), the **Lalor Foundation** is underwriting a series of predoctoral fellowships in the natural sciences, with emphasis upon their biochemical and biophysical aspects, at Harvard, Johns Hopkins, and the universities of Delaware and Pennsylvania. Selections Committees at the respective universities will furnish further information.

The **National Council to Combat Blindness** will consider applications for grants-in-aid in support of ophthalmological research up to *Apr. 15,* awards to be made in June. The Committee on Research, consisting of Phillips Thygeson, Alson E. Braley, Dan M. Gordon, Stuart Mudd, Charles A. Perera, and Samuel L. Saltzman, awarded grants-in-aid totaling $20,700 in 1951. For application blanks and further information, address the secretary of the council at 1186 Broadway, New York 1.

The **New York Zoological Society** is offering its annual grants-in-aid for summer research at the Jackson Hole Research Station. The program will include studies in ecology, animal behavior, and land management. For application blanks and further information, address the director, Jackson Hole Research Station, Moran, Wyo.

Fourteen **Sloan Fellowships** entitling recipients to participate in the MIT executive development program will be awarded to outstanding young executives in 1952. The program covers a year of advanced study in economics and business administration at the new School of Industrial Management, under the direction of Gerald B. Tallman, associate professor of marketing. Candidates must be between 30 and 35, and nomination by an employer is a prerequisite to application. Deadline for the receipt of applications is *Feb. 23.*

Smith College is offering approximately 20 graduate fellowships in botany and genetics, chemistry, geology, bacteriology, physics, and zoology. Full-time, teaching, and research (in chemistry, genetics, and physics only) fellowships are available. The Arthur D. Little Fellowship, the first industrial fellowship in a woman's college, permits full-time graduate study for three years. For application blanks (returnable by *Mar. 1*), address Florence E. Young, Graduate Office, Smith College.

Closing date for receipt of applications for the **Waksman-Merck Postdoctoral Fellowship in the Natural Sciences** at Rutgers is *Feb. 15,* and the award will be made about a month later. U. S. and Canadian citizens about to receive the Ph.D. or equivalent degree, and interested in research in basic or applied phases of biology, chemistry, or physics, are eligible for the $4,000, one-year award. Application forms may be obtained from the executive secretary of the Graduate Faculty.

In the Laboratories

Aluminum Company of America's director of research, Francis C. Frary, retired Jan. 1 and has been succeeded by Kent R. Van Horn, research metallurgist. Dr. Van Horn has been with Alcoa for 22 years, and Dr. Frary 32 years. Another veteran employee, John W. Schreiber, who has been with the company 42 years, retired as chief construction engineer, but will serve until July 1 as a special consultant on construction. He is being succeeded by L. B. Kuhns, a civil engineer who has been 27 years with Alcoa.

The **Johns Hopkins Applied Physics Laboratory** in Silver Spring, Md., has added one chemist, eight engineers, four mathematicians, one experimental psychologist, and five physicists to its staff recently.

The firm of **Bode-Lowry and Associates** has been organized by Harold E. Bode and Charles D. Lowry, Jr., to act as consultants in chemical market research and sales development. Mr. Bode has been head of chemical market research and assistant director of chemical patents for Corn Products Refining, and Dr. Lowry has been engaged in technical sales of antioxidants for petroleum and food products for the Universal Oil Products Company. Offices of the new firm are located in Chicago.

General Motors Research Laboratories has named Alfred L. Boegehold, mechanical engineer and former head of the Research Metallurgy Department, assistant to the general manager, succeeding E. V. Rippingille, Sr., who will retire Feb. 1, although he will be retained in a consultative capacity. Robert F. Thomson will succeed Mr. Boegehold. Cleveland F. Nixon, chemical engineer and director of process development for the GM Ternstedt Division, has become head of the Research Electro-Chemistry Department, succeeding William M. Phillips, who will continue on the Research Laboratories executive staff until his retirement next September.

Sterling-Winthrop Research Institute has appointed 12 new staff members: In organic chemistry, Robert

G. Christiansen, Mayo Karng, Samuel Schalit, Richard J. Stenger, and Frank C. McKay; in the Chemical Development Laboratory, Donald F. Page, Helmuth C. Neumann, William J. Kammerer, and Theodore F. Mayr; in the Pharmacy Division, Horace P. Maietta. Ruth Holzapfel has been named research assistant on the staff of Oliver H. Buchanan, secretary. This staff coordinates the research of the various divisions.

Meetings and Elections

The Executive Board of the **International Council of Scientific Unions** held its annual meeting for the first time outside Europe when it met in the rooms of the National Academy of Sciences in Washington on Oct. 16–17. It was welcomed by Detlev W. Bronk, Academy president, in an address in which reference was made to Benjamin Franklin, a great scientific ambassador. Professor von Muralt, of Bern, president of the council, had referred in his opening remarks to Louis Agassiz, first foreign secretary of the Academy and one of the first to found an international research institute, in Switzerland. In addition to the members of the board, who came from ten different countries, a number of representative American scientists attended some of the meetings of the board; they came from the Department of State, the Academy of Sciences, the National Research Council, the National Science Foundation, and a number of national scientific committees. They supported von Muralt's statement that the center of gravity of science is moving from Europe to this side of the Atlantic. In addition to the routine annual business of the board, the following items were discussed: The allocation to the council and the various Unions of the grant-in-aid for 1952 of $180,000 made by Unesco. The total allotted for the different categories (organizational expenses, publications, expenses for meetings of committees and congresses, symposia, permanent scientific services, international laboratories, administrative expenses) was fixed by Unesco. The internal allocation within these categories was made for the first time this year by the board. A new Joint Commission on Electron Microscopy was approved, its members being drawn from the Unions of Physics, Biological Sciences, and Chemistry. A special committee was authorized to consider arrangements for a Polar Year in 1957. A revised argeement with Unesco was approved. Reports from unions, joint commissions, permanent services, and international laboratories were reviewed. An international science abstracting service was started, with physics as its first subject, building on existing abstracting journals.

The business meetings of the board were followed by a "Symposium on Development of International Cooperation in Science." The speakers were F. J. M Stratton, W. A. Noyes, Jr., J. N. Mukherjee, C. J. Mackenzie, Joseph B. Koepfli, and A. von Muralt. Visits were arranged to various scientific institutions in Washington. Generous hospitality was offered to the delegates by James E. Webb, Under Secretary of State, the National Academy of Sciences, and by Dr. and Mrs. Wallace W. Atwood, Jr. It is hoped that one result of the visit of the board will be to make the activities of ICSU and the Unions more widely known among scientists in the United States.

The Section of Biology of the **New York Academy of Sciences** is holding a conference on the "Use of Antibiotics in Tropical Diseases" at the Barbizon-Plaza Hotel, New York, Jan. 17–19, following its conference on "Virus and Rickettsial Classification and Nomenclature," which was held Jan. 11–12. A third conference, on the "Biology of the Testes," will be held Jan. 25–26. All three conferences are international in scope.

Miscellaneous

The annual **Collier Trophy,** for outstanding achievement in American aviation, was awarded to the helicopter industry, the armed services, and the Coast Guard in a White House ceremony Dec. 17. The National Aeronautic Association is custodian of the trophy.

Atomic physicists from 12 European countries met at Unesco headquarters in Paris in December to draft plans for the setting up of a **European atomic research center.** Despite the need for speed, it is not expected that such a center can be set up before 1957 or 1958. Study groups will work for the next year perfecting plans for the construction, cost of which is estimated at 15–18 million dollars. George Thomson, of Britain, offered a $700,000 synchrocyclotron being constructed by the University of Liverpool, which will be ready this year, and France, Belgium, Switzerland, and Italy have made offers of various sums of money. No decision has been taken as to the site of the center, but Geneva has been offered by the Swiss.

The French chemist **Antoine Laurent Lavoisier** (1743–94) will be honored by an exhibition of printed works and manuscripts at The Grolier Club, 47 E. 60th St., New York, Feb. 19–Mar. 18. A printed catalogue will be available at the club.

Among **new journals** recently received are: *Acta Geologica Polonica,* Vol. 1, No. 4, October 1950. Quarterly, published by the Muzeum Ziemi, Warsaw (in Polish). . . . *Acta Gerontologica,* Vol. 1, No. 1, January–February 1951. Published in Milan. Clinical editor, C. Vallecorsi; editor for morphology, C. Cavallero. 3,600 lire per year. . . . *Air Repair,* Vol. 1, No. 2, November 1951. A quarterly magazine devoted to air purification, published by the Air Pollution and Smoke Prevention Association of America. Editor: Robert T. Griebling. . . . *Bulletin of the Research Council of Israel,* Vol. 1, No. 3, August 1951. Quarterly. Published in Jerusalem in English. . . . *Chemical Engineering Science,* Vol. 1, No. 1, October 1951. Bimonthly. Articles in English, French, or German, preceded by a summary in English and one other language. £4 10s per year. Academic Press is U. S. distributor.

Technical Papers

The Isolation of Living Nuclei from the Endosperm of *Cocos nucifera*[1]

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In recent years a number of techniques have been developed for the isolation of large volumes of nuclei from various animal tissues (*1, 2*). In contrast, the isolation of appreciable volumes of plant nuclei is complicated by the presence of rigid cell walls and by the fact that the ratio of nuclei to cytoplasmic materials in plants is usually lower than in animal organs.

In the coconut fruit (*Cocos nucifera* L.) the endosperm develops into a cellular tissue from a syncytium in which free nuclei are suspended in a liquid cytoplasm. Prior to cellular differentiation a stage occurs at which a large number of nuclei are closely aggregated at the walls of the embryo sac. Since these nuclei are large and only loosely embedded in a gelatinous, cytoplasmic matrix the endosperm at this stage is ideal for the isolation of large volumes of living, undamaged nuclei. The fact that coconuts are readily available on a year-round basis, and can be maintained for considerable periods in a living and sterile condition under refrigeration, enhances the usefulness of this material for studies on nuclear structure, constitution, and culture.

During the early development of the embryo sac the endosperm nuclei are suspended in the liquid cytoplasm or milk, but as the coconut matures these nuclei migrate to the periphery of the embryo sac and there undergo rapid multiplication. At the same time cytoplasmic materials coalesce around these nuclei, and presently this hyaline gelatinous mass is subdivided by cell walls. This tissue subsequently matures into the familiar hard coconut meat. The various developmental stages in the maturation of this endosperm have been described and illustrated elsewhere (*3*).

In those early stages where the nuclei are suspended in the coconut milk it is possible to harvest them by differential centrifugation and washing. However, much greater yields of nuclei are obtained from the "jelly" at the periphery of the embryo sac immediately prior to the delimitation of secondary cell walls. At these stages, the nuclei must be separated from considerable amounts of ergastic materials of an oily and crystalline nature, as well as from fragments of cell wall material. The separation described here is based upon the principle that the nuclei are the largest particles in the homogenate after preliminary filtering has removed cell wall materials, and they may be retained on a filter pad while the finer cytoplasmic materials, oils, and fats are washed away. The preparation should be carried out at low temperatures and with precooled solutions in order to prevent enzymatic decomposition.

Coconuts of the appropriate age are split and the milk is removed. The developing jellylike endosperm is gently scraped out with a spatula and suspended in 100 ml cold 4% aqueous sucrose solution in a Waring blendor. Cracked ice is added, and the mixture is blended for 5 min at 110 v. A pad composed of three layers of short-fiber, bleached, absorbent cotton wool (Johnson & Johnson, Middlesex brand) is sandwiched between single layers of 15-denier, 50-gauge nylon mesh and fitted into a Büchner funnel. The edges of the pad are crimped to the rim of the funnel to prevent seepage, and the pad is then saturated with cold sucrose solution. The endosperm homogenate is strained through 4 layers of washed cheesecloth, thus removing the coarse particles and cell wall debris, and diluted to approximately 500 ml with cold sucrose solution. This diluted homogenate is slowly poured through the cotton filter pad without suction. The filtrate is collected and repassed through the pad several times in order to entrap all the nuclei within the cotton fibers. After several passages through the pad the filtrate, which now contains only fine cytoplasmic particles, is discarded.

The pad is then washed by allowing 1000 ml of cold sucrose solution to percolate slowly through the fibers without suction. This washing removes any fine particles still enmeshed in the cotton fibers or adhering to the nuclei, and the filtrate is again discarded. When the pad has drained, another 1000 ml of cold sucrose solution is poured over it and drawn through with strong suction. As the pad drains it is pressed gently to force through all the solution. The majority of nuclei trapped in the cotton fibers will be brought down in this fraction. If this procedure is followed carefully the nuclei will be virtually free of cytoplasmic debris, and any small particles may be removed by slow speed centrifugation. The nuclei are finally concentrated by centrifuging in 50-ml tubes for 10 min at 2040 rpm.

As an example of the yield of nuclei obtainable by this method, 0.130 g undamaged nuclei may be isolated from a single coconut with a gross weight of 2000 g, containing 275 ml milk and 42.8 g gelatinous endosperm.

The nuclei prepared by this technique are living, unplasmolyzed, and undamaged and are in excellent condition for enzymatic and respiratory studies. By appropriate modifications the entire process may be carried out under sterile conditions, and the nuclei subsequently maintained in sterile culture. Prelimi-

[1] This investigation has been aided by a grant from the Jane Coffin Childs Memorial Fund for Medical Research, and in part by a grant-in-aid from the American Cancer Society upon recommendation of the Committee on Growth of the National Research Council.

nary experiments also indicate that nuclei may be isolated by the same procedure from the young endosperm of corn and from the storage parenchyma of watermelon fruits. Further aspects of these problems will be published later.

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1. Dounce, A. L. *J. Biol. Chem.*, **147**, 685 (1943).
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3. Cutter, V. M., Jr., Wilson, K. S., and Dubé, J. F. *Am. J. Botany* (in press).

Manuscript received October 11, 1951.

Delayed Speech Feedback as a Test for Auditory Malingering

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Investigators in the fields of speech pathology and communication have recently become interested in the effects of delayed feedback or side-tone delay on speech. Lee has noted that

> in order to produce delayed speech feedback, it is necessary to return the speaker's speech to his own ears approximately one-quarter second after he has spoken. This is best accomplished by means of a magnetic tape recording and reproducing machine which has independent circuits and magnets. A pair of earphones should be used to experience the effect prominently since they deliver delayed speech and exclude the normal air-borne undelayed sound which provides the normal monitoring signal (*1*).

Changes that occur in the speech pattern as a result of delayed feedback have been mentioned by some investigators as being an alteration of the normal melody pattern, slowing of the rate, an increase in loudness, a shift in pitch level, and a disintegration of rhythm. In particular, the effect of delayed side-tone upon vocal rate, intensity, and rhythm has been investigated by Lee (*1–3*) and by Black (*4*). Lee states that the phenomenon is critical with regard to time of delay and volume of the feedback. He mentions that a one-quarter second delay is necessary for the effect to be prominent and that "the volume of the delayed feedback must be sufficiently high to dominate the sound of the subject's voice which he hears through bone conduction."

Black found that even the smallest delay produced a significantly reduced oral reading rate. He noted that rate decreased with increasing time of delay from 0 to .18 sec but that beyond this point, up to a .35-sec delay, the reading rate tended to increase—not returning to normal level, however.

It was the purpose of the present investigators to check Lee's assumption that the effect is critical with respect to the volume of the feedback and at the same time to investigate the possibilities of using the results in constructing a test for the detection of bilateral auditory malingering and/or psychogenic deafness.

In the present investigation a Presto RC-1024 tape recorder was used at a tape speed of 15 in./sec, which provided for a side-tone delay of approximately .14 sec. The output of the tape recorder was led through an appropriate attenuation network to PDR-8 headphones in a sound-isolated room. A volume unit meter enabled the operator to maintain a relatively constant input to the listener's ear. Thirty speech pathology students, with a reasonable degree of sophistication in speech and hearing problems, were chosen as subjects and were divided at random into three groups. Ten listeners received feedback at approximately 35 db above a speech threshold, 10 at 55 db, and 10 at 75 db. Audiometric evaluation of all of these students had revealed that they possessed hearing acuity for pure tones within a normal range.

Speech materials to be read consisted of a 100-word passage taken from *Robinson Crusoe* and modified for ease of reading. Subjects were allowed 5 min to acquaint themselves with the passage before entering the test situation.

The procedure employed was to ask each speaker-listener to read the passage three times. For the first reading the only instruction given was to read the passage in a normal manner. For this condition, although headphones were used and speech was recorded and timed by means of a stop watch, no feedback was employed.

For the second reading the subject was instructed to read the passage as nearly as possible like the first reading. At this time the problem of malingering was explained to him and, although he was not informed of the precise nature of the present test, he was told that he should attempt to keep from being influenced by anything he should hear, since he was to feign deafness. He was told that a deaf person would not respond to any sounds coming from the phones and would therefore read the passage the second time in the same way he had the first time. He was further told that he was to try to "beat the test" by not allowing any difference between the readings. Again this reading was recorded and timed, as well as being fed back at one of the predetermined intensity levels.

For the third reading the subject was given similar instructions but, as in the case of the first reading, no feedback was used. The third reading was employed as a measure of reliability or, in this case, constancy of reading rate. It was hypothesized that, in consequence of increasing familiarity with the material, each successive reading would take less time if the experimental condition had not been imposed; therefore any retardation of rate in the second or experimental reading would be a conservative estimate of the effects of the delayed side-tone as measured by reading time.

1. In order to determine the reliability of duration of repeated readings, t tests were applied to evaluate the significance of the differences between readings 1 and 3. For all three groups these were nonsignificant. The standard error of the mean differences ranged from .15 sec to .41 sec for the three groups, with an average reading time of approximately 27 sec.

2. As readings 1 and 3 are not significantly differ-

ent, it is meaningful to test the significance of the differences between reading 1 or 3 and the feedback reading 2. For all three intensity conditions t values proved to be significant at the 1% level of confidence or beyond. Therefore we are free to reject the hypothesis that reading 1 and reading 2 are the same. It would seem likely, therefore, that the delayed side-tone produces a significantly retarded reading rate for all three intensity conditions. It is well to note that in no case, despite the instructions, did a subject read the delayed reading at a more rapid rate.

3. It is of interest to note that the magnitude of the differences between readings 1 and 2 increases with increases in intensity of the feedback over the ranges studied (35, 55, and 75 db). The mean difference between readings 1 and 2 for the 75-db intensity was 11.3 sec, for 55 db intensity 7.6 sec, and for 35 db intensity 2.7 sec. To determine whether these mean differences were different, an F test was applied. This revealed that the null hypothesis could be rejected at the .1% level of confidence.

It appears probable that reading rate is a positive function of the intensity of the delayed side-tone.

The important finding of this study would seem to be that, despite all efforts of the sophisticated subjects to overcome the effect of delayed speech, even at intensity levels which were reported by listeners as not disturbing, differences exceeding normal variation in rate were found for our sample.

Shortly after completion of this study a case of possible psychogenic deafness was presented to the authors for evaluation by the technique described. This was the case of an 11-year-old girl reporting to the Department of Otolaryngology at the State University of Iowa Hospitals complaining of severe hearing loss. Initial audiometric studies revealed losses for pure tones of between 75 and 85 db bilaterally. Her response to speech appeared inconsistent with these findings. This fact, coupled with a case history revealing emotional trauma, led the examining physician and psychologist to suspect a possible psychogenic etiology for the apparent hearing loss. So as not to reveal the actual purpose of the test, the girl was told that she would read from a picture story-book and make a record so that hospital personnel could determine what effect, if any, her hearing loss had on her speech. After establishing a normal reading pattern, the following technique was employed. Having no accurate knowledge of the loss for speech, we used an intensity of about 50-db feedback for a first reading. The abrupt and radical change in the speech pattern was so marked that no close measure was necessary to realize that the patient was responding to the feedback. From this point on the intensity level was reduced to a loudness level within the normal range of hearing acuity. It was found finally that this girl had, as far as this test was concerned, normal hearing for speech.

In view of these findings and the technique employed, it would appear that the use of the delayed side-tone or the feedback speech phenomena is feasible in the detection of malingering, and/or psychogenic deafness.[1]

References

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Manuscript received August 13, 1951.

[1] The authors would like to point out that during the early discussion of this technique as a test for auditory malingering, it was discovered that other investigators, including E. G. Witting, of the Signal Corps Engineering Laboratories, cited by Lee (*1*), and S. R. Silverman, of Central Institute for the Deaf, St. Louis, had also proposed a similar notion in the course of informal conversations reported to the present writers by Scott N. Reger.

Cis-trans Isomers of Vitamin A and Retinene in Vision

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We have recently described the synthesis of rhodopsin *in vitro* in a system of four components: vitamin A,[2] the precursor of the rhodopsin chromophore; opsin, the protein moiety of rhodopsin; and liver alcohol dehydrogenase and cozymase, the enzyme and coenzyme that oxidize vitamin A to retinene (*2, 3*). The vitamin A in our original experiments was a concentrate from fish liver oils. When this was replaced with an equivalent amount of crystalline vitamin A, the system no longer synthesized rhodopsin.

It seemed at once that this difference in behavior must have the following significance: Vitamin A, like other carotenoids, exists in a number of stereoisomeric forms, depending upon whether the groups adjacent to its double bonds are in cis- or trans- arrangement (*4, 5*). For steric reasons, only four different isomers are likely to occur in appreciable quantities (*6, 7*). Their structures are shown in Fig. 1.

The usual preparations of crystalline vitamin A probably represent the most stable, di-trans isomer. A second isomer, called neovitamin A, was crystallized by Robeson and Baxter (*5*); it probably is the Δ_9-cis form. A third modification, synthesized by Graham, van Dorp, and Arens (*8*), is probably the Δ_9-cis isomer. The di-cis isomer has not yet been identified with certainty. Fish liver oils contain mixtures of

[1] This research was supported in part by a grant from the Medical Sciences Division of the Office of Naval Research. Portions of the data were presented at the spring meeting of the Society of Biological Chemists in Cleveland in 1951 (*1*), and at the Symposium on Vitamins and Trace Elements held in honor of E. V. McCollum at The Johns Hopkins University Sept. 10–11, 1951. A detailed account of this investigation will be published in the *Journal of General Physiology*.

[2] Throughout this paper the terms vitamin A and retinene refer to vitamin A_1 and retinene$_1$. There is every reason to suppose that a similar situation involves vitamin A_2 and retinene$_2$ in the porphyropsin system, but this has not yet been explored.

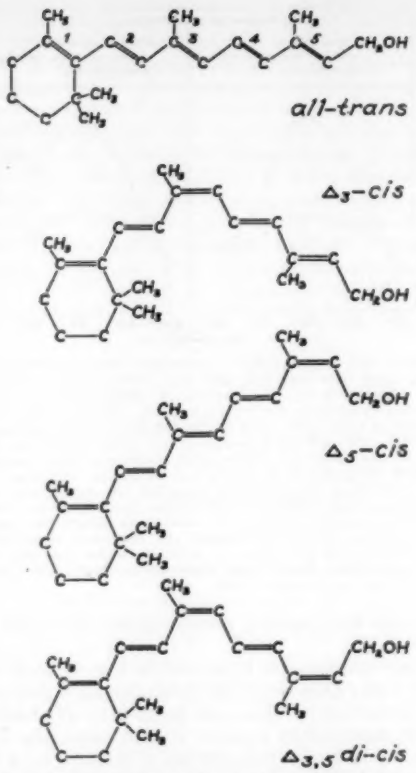

FIG. 1. Stereoisomers of vitamin A. The only forms which probably need to be considered are the di-trans isomer, two mono-cis isomers, and one di-cis isomer. Other forms probably occur only in negligible amounts (*cf.* 6, 7).

di-trans and cis-isomers in various proportions (*5, 9*). Our observation implied, therefore, that di-trans vitamin A is ineffective in the synthesis of rhodopsin, and that some cis-isomer present in liver oil is the precursor of the visual pigment.

Like other carotenoids, vitamin A is readily converted by light in the presence of a trace of iodine to an equilibrium mixture of cis- and trans- isomers (*4, 5*). When a solution of crystalline vitamin A is treated in this way, it becomes as efficient a precursor of rhodopsin as the liver oil concentrate (Fig. 2). A sample of crystalline neovitamin A, for which we are indebted to J. G. Baxter, proved to be as ineffective as the ordinary crystalline vitamin. This again, on isomerization with iodine in the light, became an effective source of rhodopsin (Fig. 2).

It can be concluded that the precursor of rhodopsin is some cis- isomer of vitamin A other than neovitamin A. The most probable such form is the Δ_3-cis isomer. We have had no opportunity as yet to test a pure sample of this material.

Such structural specificity as this is usually associated with protein reactions. The rhodopsin system includes two proteins: alcohol dehydrogenase and opsin. Which of these is isomerspecific?

We have found that crystalline liver alcohol dehydrogenase[3] acts effectively upon crystalline vitamin A and upon the natural mixture of isomers. This is hardly surprising, for liver alcohol dehydrogenase is a relatively unspecific enzyme, which accepts as substrates primary alcohols from ethanol up to vitamin A, and seems to be concerned primarily with the presence of the terminal alcohol or aldehyde group.

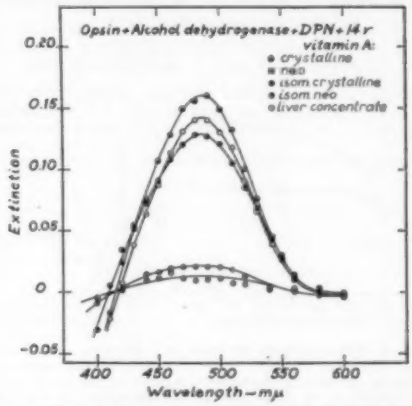

FIG. 2. The synthesis of rhodopsin *in vitro* from various configurations of vitamin A. Five solutions contain equivalent mixtures of cattle opsin, crystalline alcohol dehydrogenase from horse livers, cozymase (DPN), and vitamin A. After incubation in the dark for 15 hr at 23° C, pH 6.8, each mixture was examined for the presence of rhodopsin. The figure shows the difference spectra of rhodopsin—the differences in absorption spectrum before and after bleaching with light in the presence of hydroxylamine. From liver oil vitamin A, which contains a mixture of isomers, considerable rhodopsin had been formed. From crystalline vitamin A and crystalline neovitamin A almost no rhodopsin was formed; but after these preparations had been isomerized with light in the presence of iodine, they were about as active as liver oil concentrate.

The dominant isomer-specific component in our system is opsin. Retinene is easily prepared by the oxidation of vitamin A on a short column of solid manganese dioxide (*10*). Retinene prepared in this way from liver oil vitamin A condenses readily with opsin to form rhodopsin, whereas retinene prepared from crystalline vitamin A is almost wholly ineffective (Fig. 3). Special precautions must be taken in such experiments, for retinene is rapidly isomerized by light even in the absence of iodine. It is necessary, therefore, to shield the retinene from light throughout the course of the procedure.

Robert Gregerman, in our laboratory, has crystallized the presumptive di-trans and neoretinene prepared, respectively, from crystalline vitamin A and from neovitamin A. They differ slightly in absorption spectrum, retinene possessing an absorption maximum in ethanol at 383 mμ, neoretinene at 377 mμ. Both isomers proved to be almost entirely inactive in

[3] We are indebted to R. K. Bonnichsen for a gift of crystalline alcohol dehydrogenase prepared from horse livers.

rhodopsin synthesis. After several minutes' exposure to light, both preparations formed rhodopsin efficiently. The immediate precursor of rhodopsin, therefore, is a cis-retinene other than neoretinene. It may well be the Δ_3-cis isomer.

Which configuration of retinene is liberated in the bleaching of rhodopsin? To answer this question, we bleached rhodopsin in the dark with alcohol, to shield the newly formed retinene from isomerization by light. The retinene obtained from rhodopsin in this way is relatively *ineffective* in rhodopsin synthesis.

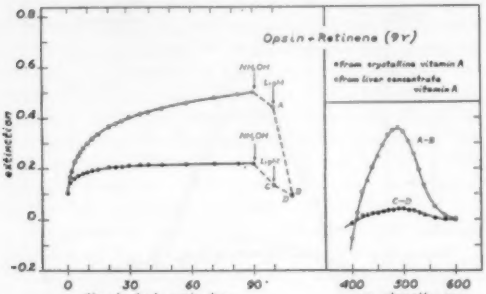

FIG. 3. The synthesis of rhodopsin *in vitro* from various configurations of retinene. Two solutions contain cattle opsin and equal amounts of retinene, prepared either from crystalline vitamin A or from the natural mixture of vitamin A isomers found in liver oil. Both solutions were incubated in the dark for 90 min at 22° C, pH 7. Then hydroxylamine was added to both, and they were tested for the presence of rhodopsin by measuring the absorption spectra before and after bleaching with light. The left-hand portion of the figure shows changes in the extinction at 500 mμ, the absorption maximum of rhodopsin; the right-hand portion shows the difference spectra of the rhodopsin which had been synthesized. Only a trace of rhodopsin was formed from the retinene derived from crystalline vitamin A, whereas the retinene derived from liver oil vitamin A yielded a large synthesis of rhodopsin.

Some years ago Chase, and Chase and Smith (*11*), reported that solutions of rhodopsin bleached with light containing blue and violet components of the spectrum regenerate rhodopsin slightly on subsequent incubation in the dark, whereas rhodopsin bleached with yellow light fails to regenerate. They noted also that blue light caused a special fall in absorption at low wavelengths (450 mμ), not found with yellow light. They concluded that their preparations contained some yellow substance, the decomposition of which by light is necessary for the regeneration of rhodopsin.

It is now clear that this substance is retinene, and that the action of light is not to decompose but to isomerize it. The absorption spectrum of retinene, maximal at about 385 mμ in water solution, extends into the violet and blue, and falls to negligible values in the green and beyond. Only light that is absorbed by retinene can isomerize it. Blue light, therefore, isomerizes retinene efficiently, but yellow light has no effect upon it. Both blue and yellow light bleach rhodopsin and yield as the immediate product an inactive isomer of retinene. Only blue light goes on to

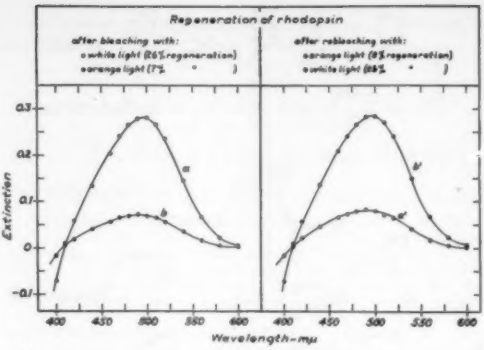

FIG. 4. The regeneration of rhodopsin after bleaching with white light (400–700 mμ) and with orange light (540–700 mμ). Two samples of a solution of cattle rhodopsin were bleached completely by irradiating for 20 min with these sources of light; then were incubated in the dark for 1½ hr at 23° C. The left-hand portion of the figure shows the difference spectra of the regenerated rhodopsin. Then samples of both solutions were rebleached as before, but with the lights reversed: the solution bleached the first time with white light was rebleached with orange light, and vice versa. Both were again incubated in the dark as before. The right-hand portion of the figure shows the rhodopsin regenerated after the second bleaching. In both cases the solutions had regenerated only 7–8% after bleaching in orange light, 26% after bleaching in white light.

isomerize this product, permitting the rhodopsin to regenerate.

These relations are illustrated in Fig. 4, which repeats under more favorable conditions an experiment first performed by Chase and Smith (*11*). The bleaching of rhodopsin by a source of light containing only wavelengths longer than 540 mμ is followed by a regeneration of 7–8 %; whereas, after bleaching with light containing all wavelengths above 400 mμ, 26% of the rhodopsin regenerates. In the experiment shown, half the rhodopsin was subjected to a second bleaching in which these lights were reversed; the sample first bleached with long wavelengths was rebleached with the entire spectrum, and vice versa. It is clear that the extent of regeneration is governed simply by the degree to which the light used to bleach rhodopsin can also isomerize retinene.

During this isomerization the absorption spectrum of the retinene liberated from rhodopsin shifts several mμ toward shorter wavelengths—from about 387 mμ to about 383 mμ—and falls somewhat in height. These changes account for the special decrease of absorption in the violet observed by Chase and Smith when rhodopsin is bleached with blue light. Such changes in spectrum are regularly associated with the stereoisomerization of all-trans carotenoids to cis-configurations (*4, 6*). We have observed them on irradiating crystalline di-trans retinene in solution with white light. They indicate that the inactive form of retinene derived from rhodopsin is probably the di-trans isomer.

Since the retinene that emerges in the bleaching of rhodopsin is a different isomer from that which enters its synthesis, the stereoisomerization of retinene or of

the corresponding vitamin A is an integral and necessary component of the rhodopsin cycle. Its place in the cycle may be expressed in some such diagram as Fig. 5.

In the eye, part of this isomerization may be accomplished by light, but this is probably not the most important way in which the retina obtains the active isomer. For one thing, it should be noted that vision continues very well in yellow, orange, and red light, in which no isomerization takes place. Furthermore, there is little opportunity for light to isomerize retinene in the eye, since ordinarily retinene is removed almost as fast as formed, by reduction to

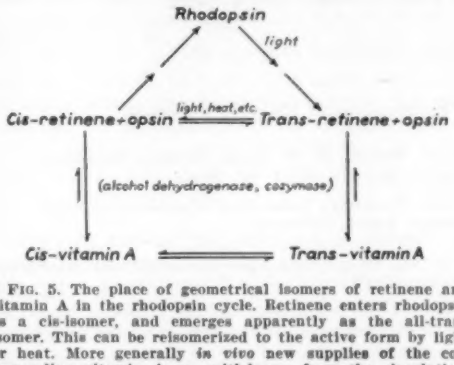

FIG. 5. The place of geometrical isomers of retinene and vitamin A in the rhodopsin cycle. Retinene enters rhodopsin as a cis-isomer, and emerges apparently as the all-trans isomer. This can be reisomerized to the active form by light or heat. More generally *in vivo* new supplies of the corresponding vitamin A are withdrawn from the circulation. On a long-term basis all the isomers of vitamin A are in equilibrium in the body.

vitamin A. For these reasons it seems probable that the eye must be continually supplied with the active isomer of vitamin A from the blood circulation, which in turn takes it from stores in the liver and, ultimately, from the nutrition. In the process of seeing, the retina continuously withdraws the active isomer of vitamin A from the circulation and returns to the blood the inactive, di-trans isomer. In this way the visual process is connected intimately with the metabolism and transport of vitamin A throughout the body.

It is probably not necessary to feed the active isomer to make it available in vision, for vitamin A apparently isomerizes in the body. After feeding either crystalline vitamin A or neovitamin A to rats, Robeson and Baxter (*5*) found that mixtures of both isomers were deposited in the liver. The rate of isomerization *in vivo* is not known, yet it seems to keep pace at least with such long-term processes as growth, since vitamin A, neovitamin A (*5*), and the cis-isomer of retinene prepared by Graham *et al.* (*8*) all are reported to yield comparable bioassays in growth tests in the rat.[4]

[4] Amending the original conclusion of Robeson and Baxter (*5*) that all-trans and neovitamin A have "substantially the same" biological potency in rats, Harris, Ames, and Brinkman (*12*) have recently reported that neovitamin A is 80.7% as potent as the all-trans isomer in promoting rat growth, and 71.5% as effective in causing the storage of vitamin A in the rat liver.

The experiments we have described introduce a new factor in the biochemistry of vitamin A—that of stereochemical specificity in its interactions with enzymes and other proteins. Certain of its reactions involve this factor acutely, others do not. We have already encountered an example of each kind: specificity in the reaction of retinene with opsin, relative indifference in the reaction of vitamin A or retinene with alcohol dehydrogenase. This type of relation will need to be considered in all future work on vitamin A metabolism.

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Making Names of Biological Taxa from Greek Stems

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The names applied to genera and higher taxonomic groups (taxa) in biology (including zoology, botany, and bacteriology) are frequently, even preferably, derived from the Greek. Appropriate transliteration is essential if the Latin name resulting is to be in good form. The Latins developed certain rules which they generally followed when adapting a Greek word to Latin usage. Presumably these rules are the ones to be observed in biology. As stated by Linnaeus in his *Critica Botanica* (Hort trans.): "When Greek names are transliterated into Latin, the equivalents used by the Romans from all time must be adopted in representing the Greek letters." And yet there is nowhere to be found a complete and sufficient summary of these principles in any of the three international biological codes of nomenclature, nothing adequate to guide in the formulation of *new* names from Greek stems. The statements appended to botanical and zoological codes are incomplete and in some cases misleading. There is in consequence much unwarranted confusion in the spelling of biological names. The bacteriologist is deeply concerned because he must constantly use the names proposed in all three major fields of biology.

A preliminary statement in the form of a recommendation relative to the transliteration of Greek to

Latin in the formation of the names of bacterial taxa has been issued by the Judicial Commission of the International Committee on Bacteriological Nomenclature (for the International Society of Microbiologists) (*1*). Some of the proposals do not agree wholly with those of Paclt (*2*) published recently in SCIENCE. This author points out some problems that will confront the zoologist who endeavors to follow certain suggestions made by Bonnet (*3*) relative to the use of *i* and *j*, and *u* and *v* in Latin words. He then proposes certain transliterations of Greek diphthongs in formation of Latin names of taxa. Although in general his suggestions are sound and in accord with classic and scientific precedent, some difficulties inherent in certain of his proposals should be pointed out.

The proper diphthongs in Greek are eight in number, five with ι and four with υ as the second letter. They are αι, αυ, ει, ευ, οι, ου, ηι, and υι.

There is substantial agreement that αι should become *ae* and οι become *oe* when transliterated. Occasionally, perhaps following the trend toward "simplified spelling," each of these diphthongs is incorrectly transliterated as *e*, with consequent confusion as to the meaning. For example, when properly transliterated, καινός ('new') is *caenus*, κοινός ('in common') is *coenus*, and κενός ('empty') is *cenus*. If all are transliterated as *cenus*, the key to the literal meaning of newly coined words is lost. In "American" English the dictionary gives 'cenogenesis' instead of 'caenogenesis' from *caenus*, 'cenotaph' from *cenus*, and 'cenobite' instead of 'coenobite' from *coenus*. With all transliterated as *cenus*, would *cenobium* mean empty life, or new life, or common life? Fortunately in this case we still recognize coenobium. The Greek αἷμα is properly transliterated *haema*, but we have such transliterations in bacterial names and epithets as *Hemophilus hemolyticus*. This particular mistransliteration causes no serious difficulty, however, as there are no Greek words in *hoem* to cause confusion.

The diphthong ει may be transliterated either as *i* or *e*. Paclt suggests that it should be rendered as *e* before a vowel and as *i* before a consonant. We have the generic names *Zea* from ζειά and *Dinosaurus* from δεινός ('terrible'). But one encounters difficulty with such a rule in the case of words like θειον ('sulfur'), which is practically always transliterated as *thium*, whence *Thiobacillus*. This transcription permits differentiation from derivatives of θειος ('divine') as in *Theobroma*. Strict application of Paclt's rule would lead to confusion.

The transliteration of ου as *u* is apparently satisfactory, although it sometimes causes difficulty for the unwary. The Greek πούς, ποδός = *pus, podis* is not uncommon as the last component of compound names, with the consequent confusion as to Latin declension, as in *Bacillus ornithopi* instead of *Bacillus ornithopodis* from *Ornithopus*.

Paclt also suggests that the Greek αυ and ευ preceding a consonant become in the Latin the diphthongs *au* and *eu*, but before a vowel they should become *av* and *ev*. The wisdom of this dictum may be questioned. The Harper *Latin Dictionary* lists 11 words transliterated from the Greek which in the latter had the prefix ευ followed by a vowel; in all these the diphthong is retained and the alternative spelling with *ev* listed as less correct. An exception is to be found in *evangelium* and its derivatives. Latin words with the first two letters *ev* are for the most part compounds with *e* as a prefix. It is suggested that the transliteration ευ = *ev* before a vowel be used only where there is good Latin precedent.

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The Intrarenal Venous Pressure

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It has been found that the intrarenal interstitial pressure (IRP) in dogs averages 25 mm Hg (*1*). Hence it was postulated that the pressure within all the fluid-filled tubes of the kidney, including tubules, lymphatics, capillaries, and venules, must exceed 25 mm Hg or else the IRP would collapse these several tubes and prevent fluid flows through them. In order to test the hypothesis, an attempt was made to measure the venous pressure above the epithelial lining of the renal pelvis.

A long 16-gauge needle was thrust through the body wall of large dogs and thence into the vena cava on the left side, opposite the entrance of the right renal vein. (Bleeding is minimal with the dog in the prone position.) Then the needle was manipulated into the renal vein. Next a saline-filled plastic catheter (nylon, OD, 0.95 mm, ID, 0.51 mm) was run through the needle, pushed through the renal hilus, and manipulated gently toward the cortex and up an interlobar vein. Working blindly, one failed in about half the attempts because the catheter's tip fouled the walls of an interlobar vein. But in the other half the catheter readily passed up an interlobar vein and into an arcuate branch. The position of the catheter's tip was determined at necropsy. The numerous venous collaterals in the kidney (*2*) are thought readily to drain away any blood which dams up behind the single catheter-blocked arcuate vein. An isometric manometer was connected with the catheter to give pressure readings when desired.

When the tip was successfully placed in an arcuate vein, the pressure here was found to be about the same as the simultaneous IRP as measured by the transduced equilibrium method (*3*). It averaged 24 mm Hg in 18 normal dogs. During the peak of glucose or urea diuresis, the arcuate venous pressure increased

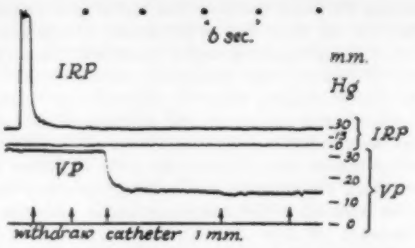

FIG. 1. Pressure changes during withdrawal of renal vein catheter from arcuate into interlobar vein. A simultaneous measurement of intrarenal pressure is shown.

to about 53 mm Hg, just as does the IRP (*4*). With pressor doses of epinephrine, it fell transiently to 9 mm Hg, as does the IRP (*4*). With increased ureteral pressures, it rose sharply, as does the IRP. The two pressures are the same under all conditions (renal arterial occlusion excepted): the coefficient of correlation between them in 23 dogs, each one subjected to various experiments, was 0.85 in a range of IRPs from 6 to 73.

When the catheter was pulled out, a millimeter at a time, while simultaneously recording its pressure changes, at a certain point during the withdrawal the pressure abruptly dropped to about 7 mm Hg. Fig. 1 shows such an experiment; in this instance the pressure dropped from 32 to 15 mm Hg. At this point, the tip of the catheter was found, by necropsy, to be in an interlobar vein, about a millimeter below the confluence of the arcuates. Evidently the point of abrupt pressure change, which we have previously postulated to be somewhere above the epithelial lining of the pelvis (*5*), lies, in the renal venous system, close to the junction of arcuates with interlobars.

Because the arcuate venous pressure is some 25 mm Hg, the pressure farther back—i.e., in the renal venules and peritubular capillaries—must be greater than 25 in order for blood to flow through them. The initial hypothesis that intrarenal venous pressure exceeds 25 mm Hg is therefore proved. At the arcuate-interlobar junction, there is presumed to be formed a physiological constriction similar to that described in a model we have constructed to study the dynamics of renal blood flow (*5*). This constriction, by interposing a resistance in the renal venous circulation, has the effect of keeping renal venous pressure higher than intrarenal pressure. Blood is, in effect, dammed up behind the constriction at relatively high pressures, and the kidney is kept inflated with blood by hydrostatic pressure from the heart (*6*).

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Establishment of an Antarctic Seismological Station[1]

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Earthquakes are believed to involve the breaking of the earth's crust under stress. Actual discovery of their location is the only means of ascertaining the action that takes place beneath the surface. They occur mainly in belts of orogenic activity and where the earth's crust is weak, and it is significant that the earthquake belts include most important mountain ranges both above and below sea level and are associated particularly with regions of major gravity anomalies.

Recording by instruments of present-day sensitivity has been carried on for the past 40 years. For accurate location three or more stations must pick up the tremors with sufficient strength, and the stations should be located at distinctly different azimuths from the quake. Thus certain belts are not completely defined, especially where they do not come within range of recording instruments, and much of the activity goes unnoticed or unlocated. This is not true for quakes of major magnitude, but the situation does exist for much of the Southern Hemisphere. Antarctica has never had an adequate teleseismic station, and the great surrounding water body prevents any good station from existing even close to the continent. Many of the Southern Hemisphere's large earthquakes are picked up only by stations of a northerly azimuth from the quake, and as a result, exact location is poor. Recordings of an antarctic seismograph station, therefore, are of definite significance.

Instruments. In choosing instruments for such a region, three important facts must be considered: first, the uncertain and difficult conditions under which they are to be established and operated; second, the instrument or combination of instruments suited for recording the data desired; and, third, the unavailability of replacements. Thus, every attempt should be made to keep the program as simple as possible.

The two seismographs used on the Ronne Antarctic Research Expedition were: (1) the Neumann-Labarre horizontal component, a tough mechanical instrument having an adjustable natural period of 1–4 sec, a magnification of about 5,000, and on which any delicate part, such as the fiber or hinge, could be easily replaced; and (2) the Sprengnether, series H, horizontal component, having an adjustable natural period of 6½–22½ sec, and a magnification varying from 2,000 to 3,000. The latter instrument was supplied with two galvanometers: one with natural period of 6½ sec, and the other with natural period of 22½ sec. Besides providing two different

[1] This paper comprises Technical Report No. 10 in the ONR Series covering the work of the Ronne Antarctic Research Expedition 1946–1948. The work was done under contract (No. N6-onr-280) with the Geophysics Branch, Physical Sciences Division, and it benefitted from the assistance and cooperation of the U. S. Coast and Geodetic Survey, the Jesuit Seismological Association, and Columbia University.

period ranges with which to work, the two galvanometers established a safety factor in case one of them was broken beyond repair. Spare parts included suspensions and coils for both galvanometers, and coils for the Sprengnether seismometer. Both seismographs worked photographically, largely eliminating friction and contraction troubles found with extreme temperatures. Other equipment included two photographic recording machines, either of which could be used for both instruments concomitantly, and an ample supply of electrical accessory equipment, consisting of light sources, bulbs, ammeters, batteries, wiring, etc. Two Navy break-circuit chronometers supplied the need for time marks, since a good timepiece is most important when it is difficult to get time checks by radio.

Setting up the station. Many fine points should be considered in selecting a site for a seismograph station; however, on an expedition such as this, consideration could be given to the major ones only; namely, solid bedrock close to base over which a strong and fairly airtight shelter can be erected. Much trouble can be eliminated if such a shelter can join the main base hut, as this one did. Digging in permanent frost where the ground is a conglomerate of boulders is practically impossible.

Solid granite bedrock within 10 ft of one of the three main buildings, built and occupied by members of the U. S. Antarctic Expedition of 1939 and 1941 (Fig. 1), was 24 ft above mean sea level and surrounded by boulders on all sides. A shack was built adjoining the main building and covering a sufficient portion of the rock for emplacement of the instruments. Although good covering wood was scarce, two layers of canvas with insulating material made the shack fairly airtight. Since it covered only part of the bedrock, and one corner did not rest on rock, this corner was supported by barrels on each side and sufficient canvas hung down to keep the enclosure airtight. Thus, vibration of the building resulting from wind or walking would not cause undue vibration in the bedrock. A floor was laid three feet above the ground with a trap door over the rock base.

After the building was completed and the trap door was made lightproof, installation began. Parts of the bedrock had to be chipped away to level the two seismographs. Later, a cement pier was used when moisture caused difficulties during the summer, but during the fall, winter, and spring such troubles did not occur.

The orientation of the Neumann-Labarre was such as to measure motion along a line 37° E of true north. The Sprengnether measured motion along a line 62° E of true north from May 24, 1947, through November 23, 1947; along a line 48° W of true north from November 24 through December 13; along a line 2° E of true north from December 14, 1947, through February 15, 1948. The seismographs were not placed at right angles because there was not enough space on the bedrock in the shack, and the instruments were used as supplements to each other, since they were of entirely different characteristics. The shorter-period

FIG. 1. Over-all view of the base.

Neumann-Labarre picked up the initial phase, whereas the Sprengnether operated better on the subsequent phases. Moreover, during microseism storms the Neumann-Labarre, being less sensitive, picked up the initial phase sharply, when the phases would otherwise be indistinguishable.

Working in the cold is most disagreeable and difficult; heavy clothes are a hindrance and gloves impossible in such work. A primus heater helped solve the problem. The two seismographs, the recorder, the galvanometer, the light sources, and necessary relays and resistances (Fig. 2) were put into the compartment below the trap door. All other necessities and controls, including batteries, chronometers, light source, and time mark controls, were put in the main building, which was usually heated. Charging the batteries, checking and winding the chronometer, and adjusting the current through the light source could all be done in relative comfort and convenience. A visit into the shack had to be made only twice a day to change paper, unless trouble was encountered.

Operation. The Neumann-Labarre seismograph ran at a natural period of 2 sec from May 18 through June 10, 1947, but the instrument did not prove sensitive enough until changed to a period of 3½ sec, using the large weight on the pendulum. At 3½ sec it ran satisfactorily from June 11 through November 15; however, as the weather grew warmer and some of the snow melted away, tilt troubles became more and more obvious. There seemed to be a correlation between the tilting of the bedrock and the heating of the sun, because the lines on the seismograms separated during the night and came together and overlapped during the warmer part of the day. On December 1, 1947, the period was cut down to 2 sec, using the small weight, and the tilt effect was partially eliminated, but the instrument also lost a great deal of its sensitivity. This may have been due to friction troubles resulting from imperfect balance of the rotating spindle. The larger weight probably had overcome some of this friction.

The Sprengnether was operated at 6½ sec natural period from May 24 through November 23; at 20 sec from November 24 through December 13; and at 22 sec from December 14, 1947, through February 15, 1948. The natural period of the seismograph was adjusted to be the same or nearly the same as the natural period of the galvanometer used in each case. The instrument worked satisfactorily with few serious difficulties.

In November, however, trouble developed with stray currents. A slight constant potential appeared in the leads to the galvanometer, gradually changing the so-called zero point on the seismogram, and as time went on this potential changed back and forth suddenly, ruining some of the seismograms. During this month the first traces of water accumulated from the melting surface snow, which was possibly responsible for a ground potential being conveyed to the circuit. A charged wire was found lying on the snow close to the shack, coming from the radio room. Consequently, the

FIG. 2. Instruments in shack.

Sprengnether was mounted on a cement pier—a far superior position as far as moisture was concerned. All leads of the circuit were more thoroughly insulated and protected, and current troubles were thereby eliminated.

At the longer natural period of 22 sec, some regular long-period seismographic disturbances of almost a minute were recorded. As reported by Florence Robertson (*1*), they were found to be correlated and eliminated by temperature and humidity control. Microseism storms were more frequent and stronger when the Sprengnether operated at 6½ sec natural period. The microseisms themselves were of a period of 4½–6½ sec, and such waves are amplified more when the seismograph operates near their period; and during the summer months of December and January the low pressure storms causing such disturbances were less frequent and severe.

Both seismographs were set up to record on the same recorder and seismogram. The recorder drum was rotated by a spring, as in a clock. During extreme cold weather the recorder exhibited a tendency to stop. This trouble was decreased by warming the instrument with a 25-w bulb in a lightproof can, placed in the recorder next to the clockwork.

Some temperature control was provided by installing a pipe from the adjoining building to the seismological shack and using a fan to blow the warmer air from the main building to the shack. This procedure proved unnecessary and completely unfeasible, be-

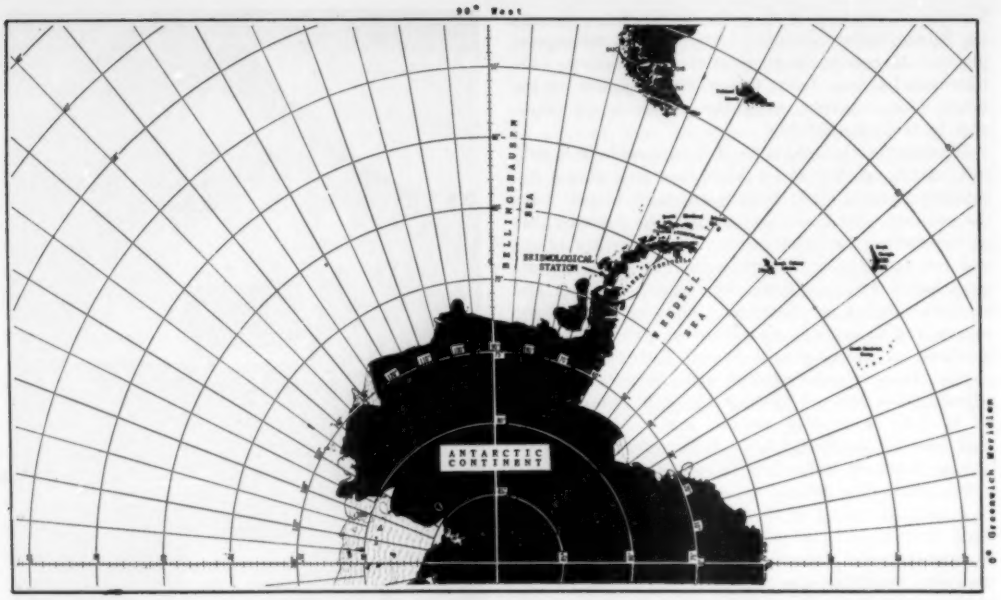

FIG. 3. Map of western half of antarctic continent.

cause the warmer air hitting the colder air naturally caused condensation. This moisture collected on the reflecting mirrors and destroyed completely the trace on the seismogram. Wind currents were guarded against with canvas and insulating material. Snow that piled high around the shack was an added and even better protection against winds.

A fairly routine operation schedule was established. The paper was changed twice a day, and the seismograms were developed and interpreted about every three days. The interpretations were radioed to the Coast and Geodetic Survey, Office of Naval Research, and the Jesuit Seismological Association on the next radio schedule with the U. S. The break-circuit chronometers, which put time marks on the seismogram every minute, were checked with the radio time signals to at least the nearest half-second every four or five days. Both light sources worked from batteries of 4 or 6 v, adjustable by rheostat, which were charged when necessary, usually every three or four weeks.

Results. In the nine months of operation about 170 earthquakes were recorded, and their interpretations are listed in *Antarctic Seismological Bulletin* (*2*). Such interpretations proved helpful in locating southern earthquakes, especially near South America and New Zealand. Some of the closer earthquakes were recorded only by the Antarctic Station. Many local disturbances were recorded, of which about 40 are listed in the *Antarctic Seismological Bulletin*. It is difficult to say which of these 40 are small local earthquakes and which are avalanches or ice falls. Since the loud avalanches noted correlated only with small local disturbance on the seismograms, it is suspected that many of the strong local disturbances may be a result of small local earthquakes. In support of this belief is the fact that local disturbances on the seismograms did not increase markedly during the warm months, when avalanches and ice falls were more frequent; but any final conclusion would be premature.

As previously stated, strong microseisms were recorded frequently by the Sprengnether seismograph. There was definite correlation between these microseisms and meteorological conditions of the area, as estimated from weather data from five British bases in the area, our station on the 6,000-ft plateau 17 miles east of the Ronne Antarctic Research Expedition Base, our base at Cape Keeler on the east side of the peninsula, and ship reports (Fig. 3). Approximate locations of the bases are as follows:

Ronne Antarctic Research Expedition Base (Marguerite Bay)—68° 11′ S, 67° 11′ W
Laurie Island in the South Orkneys—60° 45′ S, 44° 30′ W
Hope Bay—63° 15′ S, 56° 45′ W
Deception Island—62° 58′ S, 60° 35′ W
Port Lock Roy in Argentina
The Falkland Islands

There is correlation between barometric lows of sufficient depth passing over the peninsula and the microseismic activity at the main base. The same principle is used by the Navy to locate and track hurricanes in the Caribbean and Pacific Ocean areas.[2] In Antarctica, however, extratropical rather than

[2] U. S. Navy Hurricane Microseismic Research Project NAVAER 50-1R-189.

tropical lows are present. The peak of this microseismic activity usually comes when these eastward-moving low pressure storms reach the Weddell Sea (Fig. 3). There are several possible explanations as to why the storms are recorded more precisely when east of the station than west. There is the possibility of two different geological structures across which microseismic energy does not carry. The lows may deepen considerably after reaching the Weddell Sea. The bottom of the Bellingshausen Sea may be such that microseisms are not generated when a cyclone is in that vicinity. A detailed analysis of the phenomenon has been reported elsewhere (*2*).

The seismograms and all other original data can be obtained from the archives of the Geophysics Laboratory, Department of Geology, Columbia University.

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Sodium Nucleate Inhibition of Arginase Activity [1]

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It was found that under certain conditions sodium nucleate (yeast sodium nucleate, Schwartz) inhibited arginase activity. This finding was considered significant because of the universal presence of nucleic acids in all cells. A further study was then undertaken to determine the nature of this inhibition. The results of these studies are summarized in Table 1.

TABLE 1

EFFECT OF SODIUM NUCLEATE ON ARGINASE ACTIVITY

Reaction mixture	No. determinations	Micromoles urea/ml*	Percentage inhibition
Enzyme + substrate (control)	10	0.195	
Enzyme-nucleate + substrate	5	.000	100
Enzyme + substrate-nucleate	5	.190	None
Enzyme + substrate + added Mn^{++}	3	.195	
Enzyme-nucleate + substrate + added Mn^{++}	3	0.200	None

* All determinations are ± 0.015.

[1] The author is indebted to M. J. Kopac, professor of biology, New York University, for encouragement and guidance while working in his laboratory on this problem.

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The enzyme was prepared by extracting dried acetone powder of beef liver with tribasic potassium phosphate and by precipitation of the nonarginase protein by heating the extract to 60° C. The enzyme was then activated with Mn^{++} according to the method of Mohamed and Greenberg (*1*). Arginase activity was determined according to the photometric method of Van Slyke and Archibald (*2*). The enzyme contained 103 Van Slyke units of arginase per ml or 9.42

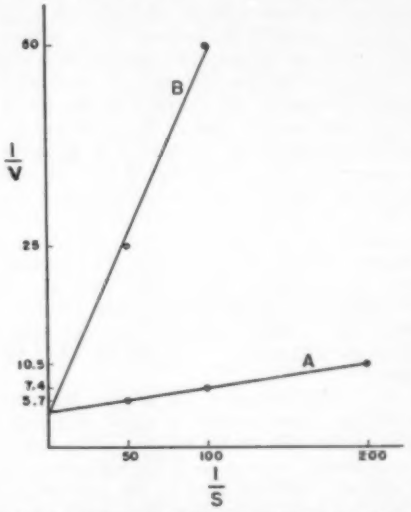

FIG. 1. Competitive inhibition of arginase by sodium nucleate. *A* represents arginase activity with no added nucleate, *B* with 0.75 mg sodium nucleate/ml added to the enzyme portion. *S* = substrate concentration in moles. *V* = enzyme activity, expressed in μM/ml.

such units per mg protein. The enzyme was diluted just prior to the reaction with the special salt solution of Kallman and Kopac (*3*). The enzyme dilution was 1:500. For the enzyme-nucleate mixture this consisted of equal aliquots of sodium nucleate dissolved in enzyme diluent and of 1:250 diluted enzyme preparation. The substrate-buffer mixture consisted of 0.06 *M* 1(+)-arginine monohydrochloride (Eastman Kodak Company) dissolved in 0.1 *M* diethyl-barbiturate buffer of pH 9.5, prepared according to Michaelis (*4*). The enzyme reaction was initiated by mixing 0.5 ml diluted enzyme preparation with 0.5 ml substrate-buffer mixture. The final substrate concentration was thus 0.03 *M*. The incubation temperature was 25° C, and the reaction period was 15 min. Under these conditions it was found that 1 mg sodium nucleate per ml of reaction mixture caused complete inhibition of arginase activity. It should be pointed out here that the sodium nucleate gradually loses its inhibitory power on standing for a few days in a dissolved state; hence, for maximum inhibition, the nucleate should be dissolved just prior to use.

In order to determine whether this inhibition was competitive, it was necessary to study the effect of

the nucleate on the enzyme, using a series of low substrate concentrations—in the range where an increase in substrate concentration causes an increase in enzyme activity—the nucleate concentration being smaller than that causing full inhibition. From Fig. 1 it is seen that if the reciprocals of the enzyme activities ($1/V$) are plotted against the reciprocals of substrate concentrations ($1/S$) a typical competitive curve is obtained, the nucleate concentration for this series being 0.75 mg/ml reaction mixture. It was postulated that the nucleate inhibition of arginase activity was caused by the removal by the nucleate of the Mn^{++} from the enzyme-Mn^{++} complex, thus rendering the enzyme inactive. The ease of inactivation of arginase by removal (by dialysis) of the activating Mn^{++} has been demonstrated by Mohamed and Greenberg (*1*). Furthermore, Neuberg and Roberts (*5*) have shown the ease of binding of Mn^{++} by sodium nucleate. According to this hypothesis, addition of more Mn^{++}—more than sufficient to saturate the binding capacity of the sodium nucleate—should restore the enzyme activity. It was found that addition of $MnCl_2 \cdot 4H_2O$ in quantities to give 0.025 mg added $MnCl_2 \cdot 4H_2O$/ml of reaction mixture (beyond the required Mn^{++} added initially for activating the enzyme) was sufficient to remove the inhibition by the nucleate.

It was further observed that enzyme inhibition is present only if the nucleate is mixed first with the enzyme portion prior to the addition of the substrate, but no inhibition takes place if the nucleate is mixed first with the substrate prior to the addition of the enzyme. The only explanation that might be given would be that the nucleate, after binding the arginine upon mixing with the substrate buffer, is incapable of removing the Mn^{++} from the enzyme-Mn^{++} complex. That sodium nucleate is capable of binding arginine was shown by Neuberg and Roberts (*5*). This interpretation also requires the assumption that arginase is capable of splitting off urea from the arginine-nucleate complex. Such a possibility would seem to be indicated from arginase specificity studies of Akasi (*6*), Boulanger and Bertrand (*7*), and Calvery and Block (*8*), who showed that if arginine is bound through the alpha NH_2 group with its COOH group free, the exposed guanidine group would be available for hydrolysis by arginase. Furthermore, since the substrate concentration employed was not in excess, there would have been a drop in enzyme activity if only those arginine molecules were available for hydrolysis which were not bound by the nucleate. However, since no drop in activity occurred, it is assumed that those arginine molecules which were bound by the nucleate were also available for hydrolysis by the enzyme.

Thus, since sodium nucleate causes a competitive type of arginase inhibition, and since the addition of Mn^{++} removed this inhibition, it is assumed that the nucleate causes enzyme inhibition by competing with the arginase molecule for the Mn^{++}. The absence of this inhibition upon mixing of the nucleate first with the substrate is explained as being due to the saturation of the nucleate binding capacity with arginine. It might further be postulated that nucleic acids, because of their enormous binding capacity, exist in the living cell in a form capable of either picking up or giving off enzyme-activating ions, depending on certain chemical changes in the cellular environment. In doing that, nucleic acids might conceivably be involved in the regulation of enzyme action inside the cell. It might be desirable to determine whether sodium nucleate would similarly inhibit *in vitro* other intracellular enzymes which require activating ions that are easily bound by nucleates.

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Control of Nosema Disease of Honeybees with Fumagillin[1]

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Nosema disease is an infectious disease of adult honeybees caused by the protozoan *Nosema apis* (*1*). It is widespread, and under favorable conditions may cause extensive losses of adult workers and queens in the winter or spring. Attempts to control it with antibiotics, sulfa drugs, arsenicals, and antiprotozoan agents have so far proved unsuccessful (*2–6*), although it was recently reported (*4*) that sulphaquinoxaline (0.2%) lowered the percentage of dead infected bees in cages by about 35%: however, one third of the dead bees were still infected. In view of these failures to control the disease, the announcement of the striking amebicidal action of a new antibiotic, fumagillin (*7*), aroused great interest. Accordingly, some of this material was obtained (through the courtesy of the Upjohn Company) and tested against *N. apis* infections.

The antibiotic was dissolved in methyl alcohol and diluted to a definite volume with water. The required dosage, together with 1 ml of inoculum, consisting of 35 million *N. apis* cysts per ml, was added to a

[1] Contribution No. 325 from the Division of Bacteriology and Dairy Research.

[2] The authors are indebted to J. Sherman, D. Mills, and R. Shone for Nosema diagnosis and to E. Braun for his interest and cooperation.

sucrose solution of such concentration as to yield 60% sugar in a final volume of 30 ml. The prepared material was then fed in bottles with perforated screw caps to bees in wire cages, each of which contained about 100 recently emerged bees. Dead bees were removed daily and examined for the presence of cysts of the parasite in the epithelial cells of the ventriculus (*4*). Since the results of the first experiment with this substance were very promising, it was repeated with various modifications. The results of both experiments are summarized in Table 1. It is clear that

TABLE 1

INFLUENCE OF FUMAGILLIN ON NOSEMA DISEASE OF ADULT BEES

Treatments	Percentage dead bees with light or heavy Nosema infection after 17 days*
Expt 1	
1 Uninoculated	0
2 Inoculated	76
3 Inoculated + fumagillin (0.15 mg/30 ml)	38
4 Inoculated + fumagillin (0.75 mg/30 ml)	18
Expt 2	
1 Uninoculated	0
2 Inoculated	76
3 Inoculated + solvent for fumagillin in amount used in #5	73
4 Inoculated + fumagillin (0.5 mg/30 ml)	6
5 Inoculated + fumagillin (1.0 mg/30 ml)	2
6 Same as #5, but kept 2 days before feeding; cysts then centrifuged down, washed, and resuspended in sugar syrup	62

* Average of duplicates.

fumagillin caused a striking reduction in number of bees infected with *N. apis* and that this inhibition was not due to the action of the solvent. Furthermore, it appears that the cysts themselves are not affected by the antibiotic, as Treatment 6 in Expt 2 was designed to show, but that this compound probably exerts its effect when the cysts germinate. Since Nosema disease is most serious in overwintering colonies, the final test of the practicability of fumagillin in controlling the disease will have to be made with infected colonies maintained under these conditions. Such an experiment is being planned.

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The Treatment of Amebiasis with Fumagillin[1, 2, 3]

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U. S. Naval Medical Research Unit No. 3,[4] Cairo, Egypt

The antibiotics now used in the treatment of amebiasis are believed to act primarily on the necessary bacterial associates of the amebae, thereby indirectly affecting the survival of the parasite (*1, 2*). Recently Hanson and Eble (*3*) have reported a new antibiotic, fumagillin, which has little antibacterial and antifungal activity. Subsequent *in vitro* experiments and animal studies by McCowen *et al.* (*4*) have shown this antibiotic to have marked amebicidal activity.

The present note reports our experiences with this antibiotic in adolescent and adult male patients who were hospitalized because of infection with the large race of *Endamoeba histolytica*. Of 22 patients treated in this series, 12 were asymptomatic, nine had symptoms of mild gastrointestinal irritation, and one had severe amebic dysentery. Fumagillin was administered orally in gelatin capsules to 18 patients for 14 days. Two patients received 5 mg daily; two, 5 mg twice daily; three, 10 mg twice daily; four, 35 mg daily in three divided doses; and seven, 50 mg daily in three divided doses. Four other patients were treated for 7 days. One received the 35-mg dosage, and three received the 50-mg dosage.

Laboratory studies on each patient consisted of frequent stool and urine examinations, stool and urine cultures, complete blood counts, blood urea nitrogen determinations, urea clearances, electrocardiography, and a battery of eight liver function tests, including prothrombin concentrations. Thiosulfate clearances were done on four patients, and in one patient the renal vein was catheterized and *p*-aminohippuric acid and creatinine extractions were performed. Evidence of therapeutic impairment of the hepatic, renal, or cardiovascular systems was not revealed by any of the clinical or laboratory procedures used in this study. Many of the patients had evidence of hepatic and renal involvement caused by schistosomiasis, but in none was the pre-existing disease aggravated.

Signs of toxicity were few and of little significance. Two patients receiving 50 mg daily complained of dizziness. In one this subsided while he was still receiving fumagillin, and in the other it subsided the day after the completion of therapy. Four other patients at this dosage complained of a loss of appetite without nausea or vomiting, but none lost weight during the period of treatment.

The disappearance of *E. histolytica* was prompt in

[1] A preliminary report.

[2] Fumagillin was supplied through the generosity of the Upjohn Company, Kalamazoo, Mich.

[3] This article has been released for publication by the Division of Publications of the United States Navy. The opinions and views set forth are those of the writers and are not to be construed as reflecting the policies of the Navy Department.

[4] Mailing address: c/o American Embassy, Cairo, Egypt.

the asymptomatic and mildly symptomatic patients. Stools became negative within 48 hr after the initiation of fumagillin treatment. In the two patients receiving 5 mg daily, the stools remained negative during treatment but became positive again within 5 days following the cessation of fumagillin therapy. One patient given 10 mg daily was positive again 6 weeks after the conclusion of treatment. This was the eighteenth post-treatment stool examination for this patient. All the other patients in this group have remained negative for *E. histolytica*, but none has been followed for more than 2 months, and some have been studied for only 3 weeks. Average number of post-treatment stools examined from each patient is 10.

The one patient with severe amebic dysentery did not respond as did the other patients. He was given 50 mg of fumagillin daily in three divided doses for 14 days, but stools which consisted almost entirely of blood and mucus on admission remained unchanged throughout treatment. During the last 5 days of treatment a sulfonamide was also administered without effect. Stools finally did become negative on the eighth day of treatment but remained negative only until the first post-treatment day. On the thirteenth day of fumagillin administration the rectal temperature reached 101° and there were signs of a hepatic mass. This mass has subsequently disappeared on treatment for an amebic abscess.

Other protozoan parasites observed in this group were *E. coli, Giardia lamblia, Chilomastix mesnili, Endolimax nana, Iodameba butschlii, Trichomonas hominis,* and *Plasmodium vivax.* All the enteric protozoa in this group were affected by the antibiotic, disappearing from the stools within 48 hr. Each, however, has recurred in at least one patient subsequent to the termination of therapy. Four patients had benign tertian malaria which became clinically apparent while under treatment, indicating the ineffectiveness of fumagillin in this infection. Other parasites present in these patients were *Schistosoma haematobium, Ascaris lumbricoides, Ancylostoma duodenale, Enterobius vermicularis,* and *Hymenolepis nana.* There was no indication of activity against any of these organisms.

The evidence thus far obtained in this study indicates that fumagillin is essentially nontoxic when given orally in dosages up to 50 mg daily for 2 weeks. It shows activity against at least 7 enteric protozoan parasites, being most effective against *E. histolytica.* Whether it will prove of definite value in the treatment of amebiasis must await further clinical trials with follow-up studies over several months. Its ineffectiveness in cases with deep amebic ulcerations is suggested.

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Kinetics of Reaction of Certain Vitamin B_{12} Analogs with Cyanide Ion

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The existence of several biologically active analogs of vitamin B_{12} has been recognized. These differ from each other in the nature of a coordinated anion, and are capable of interconversion under the proper conditions. Among the analogs so far reported, cyanocobalamin is outstanding in stability, and is formed from the others by treatment in water solution with cyanide ion (*1*). We have found that hydroxocobalamin (vitamin B_{12a}) can be titrated amperometrically with cyanide ion to a sharp end point in buffers of pH 8 or above; however, the rate at which the reaction occurs is inversely pH-dependent. The following describes some quantitative studies into the rate of reaction of cyanide ion with hydroxo- and thiocyanatocobalamin.

Reactions were carried out in 0.1 *M* borate buffers at 25°, cyanide ion concentrations being determined polarographically as described in a previous publication (*2*). The cell was charged with a solution of the appropriate cobalamin, and after purging with nitrogen for 5 min, an equimolecular amount of sodium cyanide dissolved in buffer was fed in from a syringe microburette. The recorder was then set in operation, giving in effect a graph of cyanide ion concentration versus time. Hydroxocobalamin and thiocyanatocobalamin were recrystallized preparations obtained as described by Kaczka (*3*) and Buhs (*4*). Their precise

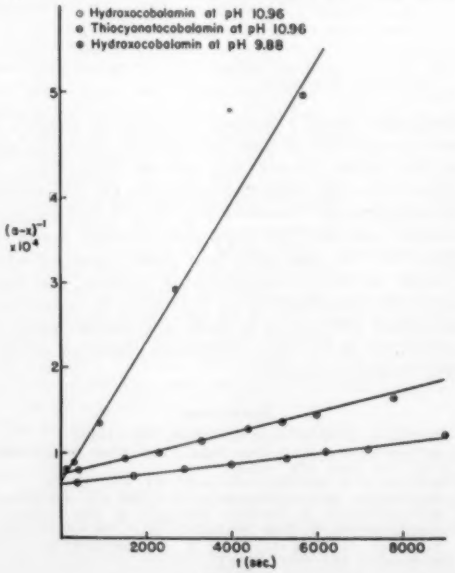

Fig. 1.

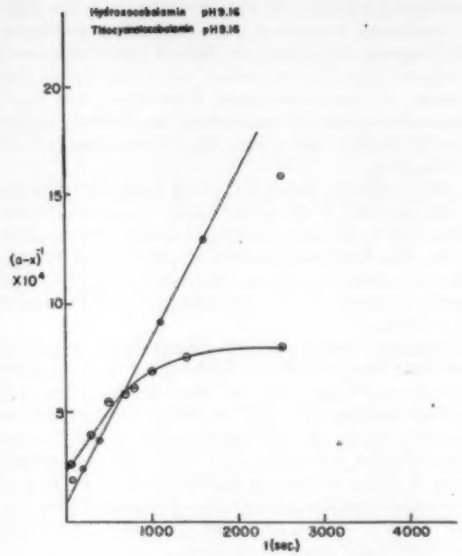

FIG. 2.

cyanide equivalents were determined by amperometric titration. Cyanide-binding impurities in the buffers were eliminated by adding to the buffer the amount of standard cyanide solution determined from a blank titration on an aliquot; the "cyanide-neutral" buffers were preserved in polyethylene bottles.

The reactants being in equimolecular proportions (about $1-2\times10^{-4}$ *M*) the reaction rate law followed is

$$\frac{1}{a-x}=kt+\frac{1}{a},$$

where a is the initial concentration of cyanide ion, and $a-x$ the concentration remaining at time t. The data assembled are graphed in Figs. 1 and 2. From the slopes of the lines, the rate constants k and half-lives $(1/ak)$ are obtained (Table 1).

In the case of hydroxocobalamin, it is to be noted that the rate constant of the cyanide-binding reaction decreases by roughly a factor of 10 for each unit increase in pH in the range studied. Since hydroxocobalamin is a pseudo base (*4*), whose basic properties are dependent on the hydrolytic reaction

$$\begin{bmatrix} - - OH \\ Co^{3+} \\ 0\ 0\ 0 \end{bmatrix}^{0} + H_2O \rightleftarrows \begin{bmatrix} - - H_2O \\ Co^{3+} \\ 0\ 0\ 0 \end{bmatrix}^{+} + OH^-,$$

the inverse rate dependence on pH is interpreted to mean that cyanide ion reacts not with hydroxocobalamin as such, but with the aquocobalamin ion in equilibrium with it (there being very much less of this ion present at pH 11 than at pH 9). It should be pointed out, however, that increase of reaction rate with diminished pH is limited by hydrolysis of cyanide ion, this becoming large below pH 9.

It is evident from Fig. 1 that the reaction between thiocyanatocobalamin and cyanide ion at pH 9.16 is not described by the rate law assumed above. The most probable explanation is that thiocyanate ion is not firmly bound by cobalamin at this pH, and that exchange with other ions in the solution occurs, giving rise to mixed cyanide reaction rates. The dissociation of thiocyanatocobalamin is clearly greater than that of the hydroxo analog at pH 10.96, since the half-life of cyanide exchange is only half as long.

These ion exchange reactions, accompanied perhaps by reversible reduction-oxidation of cobalt, are conceivably of importance in the biological function of vitamin B_{12}.

TABLE 1

RATE-CONSTANT DATA

Substrate	pH	$a\times10^4$ *M*	Rate constant	Half-life (secs)
Hydroxocobalamin	9.16	0.86	73	120
"	9.88	1.63	7.9	850
"	10.96	1.58	0.63	9800
Thiocyanatocobalamin	10.96	1.64	1.30	4700

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Evidence of Authigenic and Detrital Glauconite

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Glauconite, the general formula (*1*) of which is $R_2'O,\ 4(R''O,\ R'''_2O_3)10SiO_2\cdot4H_2O$, is a common constituent of many sedimentary rocks throughout the world, ranging in age from Cambrian to Recent. If a clear-cut distinction could be made between authigenic and detrital glauconite which would be universally applicable to glauconite-bearing sediments, a useful tool would be placed in the hands of the petrologist who is attempting to determine the origin of these sediments. Pettijohn (*2*) points out that "The distinction between autochthonous or primary glauconite, and transported or secondary glauconite, is seldom made either in recent or fossil deposits. Failure to make such a distinction has led to misconceptions concerning the genesis of glauconite."

The Upper Cretaceous, Eocene, and Pleistocene strata in the coastal plain of New Jersey afford an excellent opportunity for study of glauconite-bearing sediments. A systematic examination of glauconite grains from the several formations of this area reveals striking differences which make it possible to distinguish between authigenic and detrital glauconites.

The surface structures of the glauconite grains found in these sediments fall into two broad groups: (1) those marked by lines of deviation and (2) those that have no surface structural lines of deviation. The former group includes the following subgroups:

1. Lobate—grains with surface structures consisting of grooved indentations, which have been described as lobate, polylobate, papilliform, reniform, etc.
2. Grooved—grains characterized by surficial grooves which are relatively close to the grain periphery.
3. Tabular—parallel-grooved grains that are somewhat elongate along an axis, have parallel grooves at right angles to the long axis, and are cleavable.

The grains with surface structures that have no lines of deviation may be described as subspherical, spherical, ovaloid, cylindrical, etc.

Glauconite grains may also be classified as rounded and nonrounded. It has been found convenient to subclassify the nonrounded grains as follows:

1. Irregular—massive angular grains with no systematic surface structure, and with normal color and luster.
2. Broken or angular—grains which exhibit remnants of former surface structure, and which have the color and luster found in associated glauconite grains of other types.
3. Fragmental—grains which show little or no remnants of former surface structure, are found in the finer fractions, and are generally lighter than the glauconite grains of the same sample retained on the coarser sieves.

These classifications have been found useful for distinguishing between authigenic and detrital glauconite.

Authigenic glauconite grains show very little breaking or irregularity. They are usually rough and pitted, and the luster is dull to subvitreous. They have distinctive ovaloid to subspherical surface structural shapes, which persist even in the finer fractions. The lobate, grooved, and tabular parallel-grooved surface structures are not as well defined as they are in detrital glauconite, and it is probable that these grains are in an incipient stage of development.

Detrital glauconite, on the other hand, shows a great deal of breaking and irregularity. The surface is usually fairly smooth. Grains with lobate, grooved, and faintly grooved surface structures predominate in material over .124 mm in diameter. In material less than .124 mm in diameter, detrital glauconite is mostly fragmental, and many grains appear to be formed by the combination of smaller grains. The color of detrital glauconite is usually a shade of dark-green.

Chemical analysis[1] has shown that authigenic glauconite has a lower iron content than detrital material. Indications are that the iron has been replaced by other bases such as aluminum. E. W. Galliher (*3*) also reported in 1935 that a sample of authigenic glauconite had a similar high-iron and low-aluminum content and is thus like a sample of authigenic glauconite from the Merchantville formation. X-ray and differential thermal analyses[2] show that both authigenic and detrital glauconite are mineralogically the same.

Glauconite is more or less abundant in sections of the Magothy, Marshalltown, Mount Laurel–Wenonah, Navesink, and Tinton formations of the Upper Cretaceous; in the Hornerstown, Vincentown, and Shark River–Manasquan formations of the Eocene; and in the Pensauken and Cape May formations of the Quaternary.

The glauconite characterized as authigenic is found predominantly in the older Upper Cretaceous formations and is typically developed in the Merchantville clays. The detrital glauconite is prevalent in the formations younger than the Marshalltown and is typically developed in the Hornerstown and Pensauken formations.

Authigenic glauconite is found intimately associated with clay that is predominantly illitic. In formations such as the Raritan and the Marshalltown, especially in their northeastern outcrops, where the clay content is mostly kaolinitic, no glauconite was found. Toward the southwest, where the clay content of the Marshalltown is illitic, authigenic glauconite is found in high concentrations. The sedimentary deposits of New Jersey in which detrital glauconite is found do not contain significant amounts of clay.

E. D. McKee (*4*) distinguishes between two types of glauconite in the Cambrian Bright Angel shale—autochthonous, in beds composed of glauconite showing various stages of development from biotite; and redeposited sediments, in which the grains appear to be rounded and worn, and show no genetic relation to any other mineral. In the New Jersey sediments it may be noted that detrital glauconite occurs where it has no genetic relationship to other minerals.

Authigenic glauconite occurs in clayey formations which might well contain genetic materials. Although Galliher (*5*) has reported biotite as the source material for glauconite in Monterey Bay deposits, biotite cannot be considered as a direct source of the large amounts of glauconite in the New Jersey coastal plain. In the systematic examination of hundreds of slides, only insignificant amounts of biotite, pyroxenes, or feldspars were found in the glauconitic and associated sediments (except the arkosic, relatively nonglauconitic phase of the Pensauken). The present study confirmed the observations of S. B. Hendricks and C. S. Ross (*6*), who state that:

> Mineral associations in many greensands indicate that large supplies of micas and feldspars are not necessary for glauconite formation. Some of the greensand beds of New Jersey are many feet in thickness and are composed of nearly pure glauconite. The accumulation of biotite in such thickness and freedom from impurities would be impossible.

This study indicates that the illitic clays intimately associated with authigenic glauconite may be the source material of the New Jersey glauconite. The structural relationship between glauconite and illite had been shown by Maegdefrau and Hoffmann (*7*), and Hendricks and Alexander (*8*). The results of x-ray, differential thermal, and chemical analyses

[1] X-ray, petrographic, and chemical studies were carried on at the Rutgers University Laboratories.

[2] Differential thermal analyses were made in the Princeton University Civil Engineering Laboratory.

verify the close similarities in structure and composition between illite and glauconite, and lend support to the possibility of glauconite genesis from an illitic clay.

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Comments and Communications

Emergency Projects and University Personnel

THE following correspondence between the Association of American Universities and the Science Advisory Committee of the Office of Defense Mobilization relates to certain kinds of defense research projects and their effect on the normal activities of colleges and universities in education and research. It is submitted by its authors as a subject of general interest to the readers of SCIENCE.

UNIVERSITY OF MISSOURI
OFFICE OF THE PRESIDENT
COLUMBIA
November 6, 1951

Mr. Oliver Buckley, Chairman
Science Advisory Committee
Executive Office Building
Washington, D. C.

MY DEAR MR. BUCKLEY:

As you probably know, the members of the Association of American Universities have been giving considerable attention to the whole problem of additional compensation for faculty members working on emergency research programs, especially government contracts. At our Annual Meeting held in New Haven on October 23–24, the Association with thirty-three of the thirty-seven member institutions represented unanimously adopted the following resolution:

The resolution, as amended and adopted, reads as follows:

> The present period of rearmament and national emergency has resulted in a heavy demand upon universities and university faculties to undertake defense research and other emergency services for the government. Our universities must accept their proper share of responsibility in meeting the security needs of the nation. Thus they are faced with the difficult, dual responsibility of assisting the government in its immediate and emergency needs, while at the same time preserving as fully as possible their basic and long-range activities in education and creative scholarship. In recognition of the difficulties inherent in this dual responsibility
>
> BE IT RESOLVED:
>
> (1) That the Association of American Universities reaffirms the importance of our universities' maintaining their primary functions in meeting the critical educational needs of the nation and of maintaining those policies and environmental conditions most favorable to free and creative scholarship.
>
> (2) That the Association of American Universities recognizes that in the national emergency, some institutions will be operating under government contracts, large research programs requiring these institutions to draw on the staffs of other universities or colleges for the temporary loan of faculty members, but registers the opinion the number of such programs should be kept to the minimum consistent with national security and only initiated when the need of the Government is clearly of utmost importance to the defense of the nation; and that to this end it further urges the Science Advisory Committee of the Office of Defense Mobilization to take steps to ensure that there be careful screening of these projects.
>
> (3) That in the operation of such projects the universities recognize their responsibilities: (*a*) to manage these projects in a manner that is least disruptive of the normal educational and research activities of their own faculties and those of other institutions, and (*b*) to avoid whenever possible personnel policies and rates of compensation for these emergency projects which might embarrass or weaken other institutions. It is vital that the nation's universities preserve the incentives, prerogatives and attractiveness of academic appointments, and that they avoid policies which make educational and basic research activities poor relations of sponsored research.
>
> (4) Recognizing the possibility of special exceptions, the Association of American Universities feels that in general government funds should not be used to increase the monthly rate of compensation of staff members engaged on government research at the university of which they are members, or those on leave of absence from another institution.
>
> (5) That the Association of American Universities goes on record as favoring a policy of personnel rotation on university defense projects which will enable faculty members to return to their academic duties at their own institutions at the end of some period, preferably one, but not to exceed two academic years.

You are free to use this Resolution in any of your conferences and deliberations. If it would be helpful for any

other government offices to have copies of this document, I should be glad to forward it to them.

Very truly yours,
F. A. MIDDLEBUSH, *President*
Association of American Universities

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF DEFENSE MOBILIZATION
WASHINGTON, D. C.

November 20, 1951

DEAR DR. MIDDLEBUSH:

This will acknowledge receipt of your letter of November 6 in which, as President of the Association of American Universities, you bring to the attention of the Science Advisory Committee the resolution passed by the Association concerning the role played by American universities in the emergency defense program.

The Committee is aware of the heavy demand upon universities and university faculties to undertake research and other emergency services for the government. It also realizes the importance of preserving as fully as possible the basic and long-range activities of the universities in education and creative scholarship. Thus an academic institution may well face a difficult decision with respect to acceptance of a defense project of large magnitude or special character or with respect to facilitating transfer of personnel to such a project in another institution.

It is the aim of the Science Advisory Committee to be helpful in every possible way to the universities as well as to government agencies in achieving the most effective use of the scientific talent of the nation for defense. In accordance with this aim, the Committee is willing to give its opinion as to the wisdom of undertaking a defense research project of the type referred to in your resolution or of transferring a scientist to such a project when in the opinion of the institution such action might be expected to disrupt seriously a normal program of research and education. Other situations may arise, too, in which a university is confronted with more than one alternative for defense research when advice from the Committee might be helpful.

It is our understanding that the number of such projects currently under consideration is small and not likely greatly to increase. Thus it is hoped that the Committee would, with the cooperation of other government agencies, be able to undertake reviews of particular projects on request from academic institutions. Obviously the Committee, which is solely an advisory body, could not assume functions which are the responsibility of other government Departments, nor would it be practicable for the Committee to express its opinion on minor projects of which there are a great number. If, however, it should develop that there is need for review beyond that which the Committee is prepared to undertake, an endeavor will be made to find an appropriate mechanism for solving this problem.

In any case the services of the Committee and its members are available to all colleges and universities of the country in this matter which we regard as one of great importance.

If further discussion of this subject would be helpful, please be assured of my personal readiness and availability.

Sincerely yours,
OLIVER E. BUCKLEY, *Chairman*
Science Advisory Committee

Scientific Book Register

Adrenal Cortex. Transactions of the Second Conference, November 16–17, 1950, New York. Elaine P. Ralli, Ed. New York: Josiah Macy, Jr. Fdn., 1951. 209 pp. $3.00.

The Attitude Theory of Emotion. Monogr. No. 81. Nina Bull. New York: Nervous and Mental Disease Monographs, 1951. 159 pp. $6.00.

Die Mathematischen Hilfsmittel des Physikers. 4th rev. ed. Erwin Madelung. W. Berlin: Springer-Verlag, 1950. 531 pp. DM 47; DM 49.70 bound.

Lenses in Photography: The Practical Guide to Optics for Photographers. Rudolf Kingslake. Garden City, N. Y.: Garden City Books, 1951. 246 pp. $2.95.

Penicillin Decade, 1941–1951: Sensitizations and Toxicities. Lawrence Weld Smith and Ann Dolan Walker. Washington, D. C.: Arundel Press, 1951. 122 pp. $2.50.

Management and Conservation of Vegetation in Africa: A Symposium. Farnham Royal. Bucks, Eng.: Commonwealth Agricultural Bureaux, 1951. 97 pp. 10s. 6d.

Proceedings of the Second Berkeley Symposium on Mathematical Statistics and Probability. Jerzy Neyman, Ed. Berkeley: Univ. California Press, 1951. 666 pp. $11.00.

Factors Regulating Blood Pressure. Transactions of the Fifth Conference, February 15–16, 1951, New York. Benjamin W. Zweifach and Ephraim Shorr, Eds. New York: Josiah Macy, Jr. Fdn., 1951. 238 pp. $3.75.

International Pharmacopoeia, Vol. I. Geneva: World Health Organization, 1951. Distributed by Columbia Univ. Press, New York. 406 pp. $5.00.

Reference Book of Inorganic Chemistry. 3rd ed. Wendell M. Latimer and Joel H. Hildebrand. New York: Macmillan, 1951. 625 pp. $5.00.

A Handbook of Space Flight. (Technical information in tabular form.) Wayne Proell and Norman J. Bowman. Chicago: Perastadion Press, 1950. 185 pp.

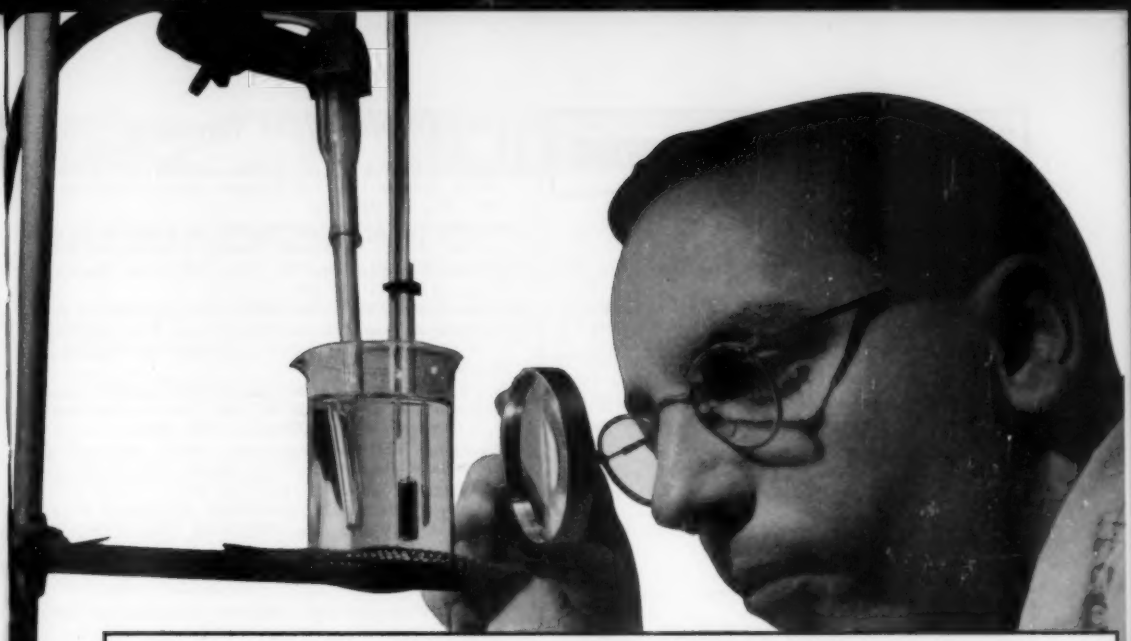
Problems of Aging. Transactions of the Thirteenth Conference, February 5–6, 1951, New York. Nathan W. Shock, Ed. New York: Josiah Macy, Jr. Fdn., 1951. 194 pp. $4.00.

Elements of Social Organization. Josiah Mason lectures delivered at the University of Birmingham. Raymond Firth. New York: Philosophical Library, 1951. 257 pp. $5.75.

Substances Naturelles de Synthèse: Préparations et Méthodes de Laboratoire, Vol. III. Léon Velluz, Ed. Paris: Masson et Cie., 1951. 156 pp. 1,500 fr.

First Year College Chemistry. John W. Barker and Paul K. Glasoe. New York–London: McGraw-Hill, 1951. 501 pp. $5.00.

Nerve Impulse. Transactions of the Second Conference, March 1–2, 1951, New York. David Nachmansohn, Ed. New York: Josiah Macy, Jr. Fdn., 1951. 204 pp. $3.50.



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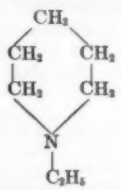

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Publications Received

Expedition to South-West Arabia, 1937–8, Vol. I, Nos. 16–19. London: British Museum (Natural History), 1951. Pp. 179–306. 20s.

Industrial Uses of Radioactive Fission Products. A report to the U. S. Atomic Energy Commission, SRI Project No. 361. Stanford, Calif.: Stanford Research Inst., Sept. 1951. 102 pp.

Informe Annual 1950. Cajon Official No. 74; ***Historico del Servicio Antipaludico en Bolivia.*** La Paz, Bolivia: Division de Endemias Rurales, Ministerio de Higiene y Salubridad, 1951.

Informe del Comisionado de Agricultura y Comercio para el Año Fiscal 1949–1950. R. Colon Torres. San Juan, P. R.: Departmento de Hacienda, 1951. 239 pp.

International Sanitary Regulations, WHO Regulations No. 2. Tech. Rept. Ser. No. 41. Geneva: World Health Organization, July 1951. 100 pp. 5s, 65¢, or Sw. fr. 2.60.

International Statistical Conferences, September 6–18, 1947, held at Washington, D. C. Vols. 1 and 3 (Pts. A and B). Proc. Intern. Statistical Conferences. The Hague, Netherlands: International Statistical Institute.

Iodine, Its Properties and Technical Applications. New York: Chilean Iodine Educational Bur., Sept. 1951.

Lilloa Revista de Botanica, Vol. 22. Horacio R. Descole, Ed. Buenos Aires, Argentina: Universidad Nacional de Tucumán, 1949.

Load Carrying Capacity of Roads as Affected by Frost Action. Highway Research Board Bull. No. 40. Washington, D. C.: Highway Research Board, Oct. 1951. 38 pp. 75¢.

Medical Milestones. Henry J. L. Marriott. Baltimore: Williams & Wilkins, 1952. 293 pp. $3.50.

The Microscope, Its Application, Use and Care. E. G. Keller, Ed. New York: E. Leitz, Inc., 1951.

Moderne Allgemeine Mineralogie. Werner Nowacki. Braunschweig: Friedr. Vieweg & Sohn, 1951. viii + 64 pp.

North American Fireflies of the Genus Photuris. Herbert S. Barber. Smiths. Misc. Collections. Vol. 117, No. 1; ***Additional Forms of Birds from Colombia and Panama.*** Alexander Wetmore. Vol. 117. No. 2; ***Middle Cambrian Stratigraphy and Faunas of the Canadian Rocky Mountains.*** Franco Rasetti. Vol. 116, No. 5. 34 plates; ***A Review of the Mysidacea of the United States National Museum.*** Walter M. Tattersall. U. S. Natl. Museum Bull. No. 201. Washington, D. C.: Smithsonian Institution, 1951.

Offerings and Enrollments in High-School Subjects. Chapter 5 of ***Biennial Survey of Education in the United States, 1948–50.*** 118 pp. 30¢; ***Vitalizing Secondary Education.*** Report of First Commission on Life Adjustment Education for Youth. Bull. No. 3, 1951. 106 pp. 30¢; ***Residence and Migration of College Students, 1949–50.*** Misc. No. 14. Robert C. Story. 61 pp. 35¢. ***Medical Group Practice in the United States.*** Public Health Service Pub. No. 77. G. Halsey Hunt. Washington, D. C.: Federal Security Agency, 1951. 70 pp. 25¢.

On a Rare Deep-Sea Fish Notacanthus Phasganorus ***Goode (Heteromi-Notacanthidae) from the Arctic Bear Isle Fishing-Grounds,*** Vol. I, No. 5, Zoology Ser. Denys W. Tucker and J. W. Jones. London: British Museum (Natural History), Nov. 1951. 79 pp., 3 plates. 5s.

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Jan. 28–31. Symposium on Modern Methods of Analytical Chemistry (Annual). Louisiana State University, Baton Rouge.

Jan. 28–Feb. 1. Institute of the Aeronautical Sciences (Annual). Hotel Astor, New York.

Jan. 29–31. American Meteorological Society. Roosevelt Hotel, New York.

Jan. 29–Feb. 2. American Library Association (Midwinter). Edgewater Beach Hotel, Chicago.

Jan. 31–Feb. 1. American Society for Metals (Midwinter Technical). William Penn Hotel, Pittsburgh.

Jan. 31–Feb. 2. American Physical Society (Annual). Columbia University, New York.

Feb. 1–2. Protein Conference (Annual). Bureau of Biological Research, Rutgers University, New Brunswick, N. J.

Feb. 3–8. American Society for Testing Materials. The Shoreham, Washington, D. C.

Feb. 8. American College of Radiology. Palmer House, Chicago.

Feb. 15–16. Mathematical Association of America (Louisiana-Mississippi Section). Northwestern State College, Natchitoches, La.

Feb. 17–24. Brotherhood Week.

Feb. 18–Mar. 7. British Commonwealth Scientific Official Conference. Canberra and Melbourne, Australia.

Feb. 23. American Mathematical Society (Eastern). Columbia University, New York.

Feb. 24–29. Latin American Congress of Physical Medicine. Panama City, R. P.

Feb. 25. Massachusetts Society for Research in Psychiatry. Cushing Hospital, Framingham.

Feb. 26–28. American Concrete Institute. Netherland Plaza Hotel, Cincinnati.

Feb. 28–Mar. 1. National Conference on Rural Health. Shirley-Savoy Hotel, Denver.

Feb. 29. Natural Gasoline Association of America. Lincoln Hotel, Odessa, Tex.

Mar. 3–5. National Cancer Conference. Netherland Plaza Hotel, Cincinnati.

Mar. 3–7. American Society for Testing Materials (Spring). Cleveland.

Mar. 6–8. American Academy of Forensic Sciences (Annual). Biltmore Hotel, Atlanta, Ga.

Mar. 10–13. National Electrical Manufacturers Association. Edgewater Beach Hotel, Chicago.

Mar. 10–13. New Orleans Graduate Medical Assembly (Annual). Municipal Auditorium, New Orleans.

Mar. 10–14. National Association of Corrosion Engineers (Annual). Galveston.

Mar. 16–19. American Institute of Chemical Engineers. Atlanta Biltmore Hotel, Atlanta.

Mar. 17–19. Midwestern Conference on Fluid Mechanics. Ohio State University, Columbus.

Mar. 17–22. Pakistan Association for the Advancement of Science (Annual). Peshawar University, N.W.F.P.

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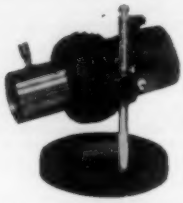

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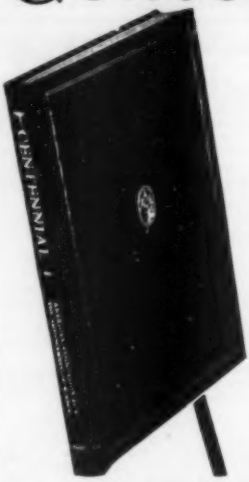

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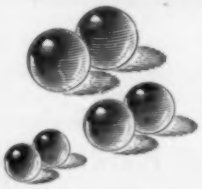

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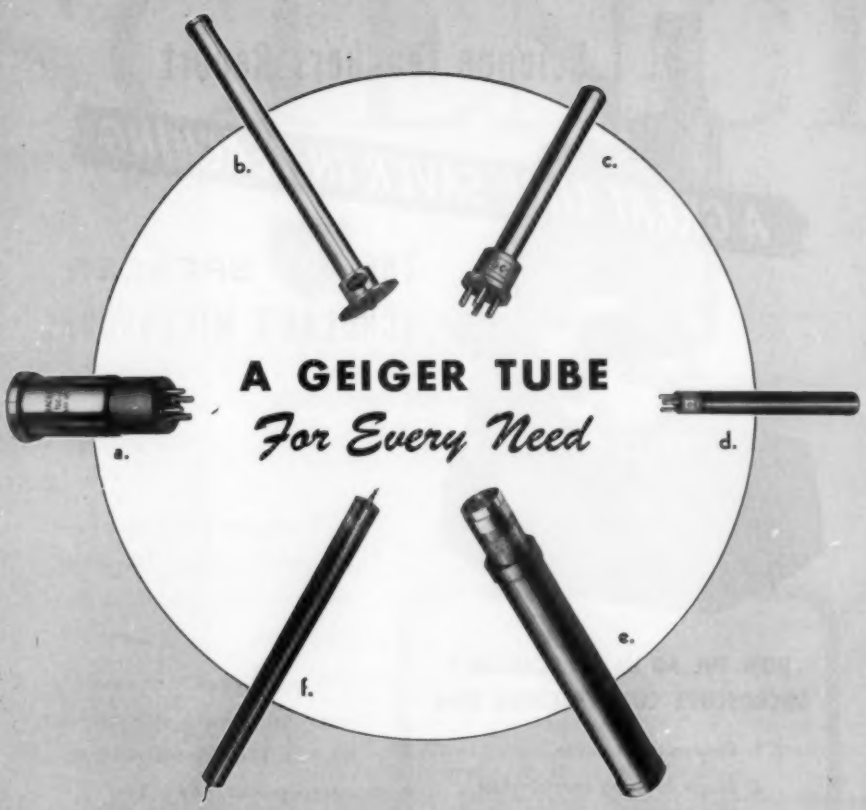

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